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CLINICAL AND EXPERIMENTAL STUDIES OF INTRACRANIAL TUMORS WITH FLUORESCEIN DYES

WITH AN ADDITIONAL NOTE CONCERNING THE POSSIBLE USE OF K^{42} AND IODINE 131 TAGGED HUMAN ALBUMIN*†

By G. E. MOORE, C. M. CAUDILL, J. F. MARVIN, J. B. AUST, S. N. CHOU, *and* G. A. SMITH

MINNEAPOLIS, MINNESOTA

WITH the introduction of asepsis and of anesthetic agents the horizons of general surgery were rapidly extended. Neurosurgery, on the other hand, lagged behind. Its growth was dependent not only upon more rigid conditions of asepsis and the development of unique technical procedures, but also upon the evolution of diagnostic methods for accurately localizing intracerebral lesions. Although improved neurological knowledge and the advent of roentgenology allowed an increased scope of operative intervention, fuller realization of surgical technique awaited the discovery of ancillary diagnostic procedures.

Probably the greatest single contribution to the development of neurosurgery was the introduction by Dandy of pneumographic techniques. More recently cerebral angiography and electroencephalography have been discovered, refined, and finally added to the permanent diagnostic armamentarium of the neurosurgeon.

In the last few years an attempt has been made to utilize a unique property of central nervous system vessels (blood-brain barrier) for the diagnosis and localization of brain tumors.[2]

It has been found that most positively charged (basic) dyes are readily able to penetrate into the central nervous system, while negatively charged dyes (acidic) are generally incapable of passing into the brain tissue. Under many pathological conditions, this differentially permeable barrier is broken down locally. In the presence of a tumor or abscess an acid dye will easily penetrate into the area of the lesion but not into the surrounding normal brain substance. The clinical value of using dyestuffs for localizing brain tumors at operation, or preoperatively with radioactive substances, is dependent upon the detection or differences in concentration of the dye in the lesion and in the surrounding normal brain.

The acid-chromagen dye sodium fluorescein has proved most useful clinically since low tissue concentrations can be

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readily detected because of the highly fluorescent properties of the dye under ultraviolet light. The clinical results obtained with the fluorescein technique have been reported previously.[2,3] At this institution the method has been used routinely for every craniotomy in which a brain tumor is suspected. A summary of the results obtained is found in Table I.

TABLE I

DIAGNOSIS OF CEREBRAL INTRACRANIAL LESIONS WITH FLUORESCEIN

Diagnosis	Fluorescent	Non-fluorescent
Gliomas	72	6*
Meningiomas	36	1
Other neoplasms	24	3
	132	10

* Three errors were slow-growing astrocytomas.

One of the best features of the fluorescein test is its simplicity. The only equipment necessary is a good source of ultraviolet light. The CH-4 mercury vapor spot lamp with a Wood's filter is excellent. Several models of such a lamp are available commercially. The test is carried out in the operating room and requires no additional personnel. The surgeon merely hands the biopsy material suspected of containing tumor tissue to the room nurse who in turn holds the tissue under the ultraviolet lamp. The neurosurgeon need not move from his operating position to examine the specimen. Usually, it is not necessary to darken the room; only turn off the main operating lights momentarily.

The technique is most valuable for the identification of deeply situated tumors which are being probed for with a ventricular needle. The direct examination of the operative field is less satisfactory because of the presence of damaged tissue and of blood which obscures the fluorescence.

In the laboratory the fluorescein test has been used for the evaluation of brain damage following the intravenous and intra-arterial injection of various noxious agents. Most interesting are the changes seen after the intra-arterial injection of radiopaque media commonly used to perform cerebral angiograms.

A series of rabbits were injected intra-arterially with 35 per cent and 70 per cent diodrast and later fluorescein was administered intravenously. When the brains were exposed and examined under ultraviolet light, a certain number revealed an intensely fluorescent hemisphere on the side of the injection indicative of a broken blood-brain barrier. It was found that some batches of the dye impaired the cerebral vessel permeability consistently, while ampules obtained from another shipment seldom caused disruption of the blood-brain barrier.

ISOTOPE ENCEPHALOMETRY

Efforts to utilize sodium diiodofluorescein tagged with I^{131} for the preoperative localization of brain tumors has been documented previously.[3] Briefly, the procedure consists of the intravenous injection of the radioactive dye and, after an interval of about thirty minutes, examination of symmetrical areas of the head with a specially shielded Geiger-Müller counter.

Initially, paired symmetrical areas were compared separately and little attention was given to differences in absolute counting rates. Any increased counting rate over a given area was interpreted as evidence of a brain tumor. This was fallacious since obviously the test does not discriminate between brain tumor and other lesions (localized encephalitis) which may also disrupt the blood-brain barrier and therefore result in differentially high counts. Generally, however, the edematous brain surrounding an abscess does not take up sufficient radioactive dye to allow localization. Several patients with subdural hematomas were thought to have brain tumors on the opposite side because of the differentially high counts. When these results were compared to normal levels of

activity obtained at these positions, it could be seen that the levels of activity on the side of the lesion were absolutely lower. This illustrates the value of establishing normal activity values for each position.

Another biological limitation of the radioactive fluorescein technique is the amount of dye "taken up" by the tumor. Unless the tumor contains at least enough dye to give 10 per cent more activity than the entire radioactivity viewed by the Geiger-Müller counter, it cannot be detected. Since some tumors such as acoustic neuromas seldom contain more than two times the amount of dye in the surrounding normal brain they are almost undetectable. It must be recognized, therefore, that with the present instrumentation and tracer material used at this clinic, such lesions as pituitary tumors cannot usually be detected for three reasons: they do not take up much dye; they have a small volume, and they are deeply situated. On the other hand, glioblastoma multiforme and metastatic tumors which may contain thirty times more radioactive dye than the normal brain are most easy to localize. In addition, tumors containing larger concentrations of dye can be smaller in volume, yet still be detectable. Many of these more malignant tumors are surrounded by an area of edematous brain which also contains an appreciable amount of dye. Under these circumstances very small neoplasms can be localized.

The role played by abnormal protein binding in the presence of brain tumors or inflammation is to be determined. That such a mechanism may affect the optimal effectiveness of compounds used and their specific activity must be considered.

The most important physical problem involved in a successful utilization of the radioactive dye method is the proper shielding of the Geiger-Müller counter to obtain maximum directional characteristics without lowering the counting rate to a degree incompatible with the obtaining of significant counts in a reasonably short interval—preferably less than three minutes. A résumé of the various Geiger-Müller counters used and the results obtained with diversified shielding have been reviewed elsewhere.[3]

Table II

EXCERPT OF DIIODOFLUORESCEIN TEST DONE SEPTEMBER 15, 1950

(dose of radioactivity = 22 μc./kg.)

Position	Side	Counts per Minute	Differential
(1) Forehead	R	3,656	R—8%
	L	3,370	
(2) Temporal	L	3,472	
	R	3,814	R—9%
(3) Frontal (45°)*	R	3,747	R—24%†
	L	2,843	
(4) Frontal (top)	L	3,387	
	R	3,563	R—5%
(5) Earline (lat.)	R	2,488	R—2%
	L	2,419	
(6) Earline (45°)	L	2,420	
	R	2,568	R—6%
(7) Earline (top)	R	2,856	R—5%
	L	2,720	

* Forty-five degrees between sagittal and transverse planes.
† Site of tumor—diagnosis: glioma.
Comment—If the tumor is accompanied by much brain edema, the entire affected hemisphere may give a higher counting rate.

At present a shielded Geiger-Müller counter obtained from the Texas Company has been found most useful clinically. It is mounted on an extensible arm of a dental roentgen-ray unit. A small decade scaler* with a pre-set interval timer is also mounted on the unit. Of a series of 33 patients consecutively studied with this equipment, accurate diagnoses were made in 28, errors in 2, and 3 remain under observation. The errors (false negative) occurred in a patient with a 2 cm. subcortical astrocytoma in the temporal lobe, and a second patient with an intracranial extension of a transitional cell carcinoma of the face.

Table II depicts the counting rates ob-

* Berkley Model No. 1,000-B.

tained from a patient subjected to the diiodofluorescein test.

In addition to radioactive diiodofluorescein, many other radioactive compounds have been screened in the laboratory by studying their uptake in experimental brain tumors. Two radioactive agents which have received clinical trial are radioactive potassium (K^{42})[5] and iodinated (I^{131}) human albumin.

Radioactive potassium has the following advantages: (1) energetic gamma emission (1.5 mev.); (2) excellent differential concentration in brain tumors which seems to parallel the degree of cellularity, and (3) a short half-life. Its disadvantages are: (1) that the short half-life (12.4 hours) makes its use difficult by clinics at a distance from the sources of supply; (2) the higher energy gamma radiation increases the personnel protection precautions which must be taken and necessitates more bulky shielding of the detector unit in order to obtain collimation; (3) the isotopic solution must be neutralized, buffered, and sterilized for intravenous use, and (4) the extremely high rate of potassium uptake by muscle tissue precludes its use for the diagnosis of posterior fossa tumors—an area of the skull covered by the thick nucal muscles. Table III represents the results obtained.

TABLE III

EXCERPT OF K^{42} TEST DONE ON MRS. H. R.
(3 mc. K^{42} given intravenously)

Position	Side	Counts per Minute	Differential
(1) Forehead	R	7,600	
	L	8,000	L—5%
(2) Temporal	L	12,000	L—34%*
	R	8,000	
(3) Earline (lat.)	R	7,000	
	L	8,350	L—16%*
(4) Behind ears (lat.)	L	8,200	L—7%
	R	7,600	
(5) Frontal (top)	L	7,000	L—4%
	R	6,700	
(6) Earline (45°)	L	7,200	L—2.5%
	R	7,000	

* Site of tumor—glioblastoma.
Approximate differential percentage.

TABLE IV

THYROID UPTAKE OF I^{131} AFTER I^{131} PROTEIN TEST

Days	Mrs. H. W. Dosage 69 microcuries Without Lugol's solution	Mr. A. P. Dosage 57 microcuries With Lugol's solution
	counts per minute	*counts per minute*
0	1,100	650
1	1,200	580
2	1,250	540
3	2,600	450
4	3,500	300
5	3,700	

As a result of the clinical use of iodinated (I^{131}) protein for blood volume determinations, this agent was also investigated as to its possible usefulness for brain tumor diagnosis. Since most of the iodinated albumin* is metabolized by the body[6] and the radioactive iodine freed, it has been necessary to block the thyroid with stable iodine (Table IV). Ten drops of Lugol's solution was given at eight hour intervals for forty-eight hours preceding administration of the tagged protein. Table IV reveals the efficacy of this precautionary measure. To date, not more than 70 microcuries of the iodinated albumin has been given per patient. One advantage of this agent is the fact that it is slowly cleared from the brain tumor. In actual practice, the highest differential counts have been obtained on the second and third days following its administration. Whether this prolonged retention results entirely from its larger particle size is not known.

With the small dosage employed at present, it is difficult to obtain satisfactory, valid results without longer counting intervals than are compatible with the comfort of most patients with brain tumors.

* Obtained from the Abbott Laboratories.

Table IV represents daily counts over thyroid after I^{131} protein was given intravenously in patients with and without being given Lugol's solution.

Table V represents the findings obtained with iodinated protein.

At present the radioactive agent of choice is sodium diiodofluorescein but further investigation may reveal other compounds in which radioactive isotopes can be incorporated which will yield more accurate results.

A multiple detector unit has been developed in an attempt to reduce the time necessary for complete examination of the head. With such an apparatus equipped with an electronic switch and a pre-set interval timer, eight positions are simultaneously counted. This should be of greater value in the future when counters of smaller volume and demanding less shielding are available. At present the shielding necessary to obtain optimal directivity makes it unwieldy.

Scintillation counters which are much more efficient for the detection of gamma rays and theoretically offer many advantages over Geiger-Müller counters have been, in reality, difficult to adapt to clinical use. For example the light pulses produced in anthracene by low energy gamma waves (I^{131}, 0.36 and 0.6 mev.) converted to electrical pulses by a photomultiplier tube (P-M tube) are very similar in character to the noise pulse emitted by the P-H tube. Although refrigerants can be used to significantly reduce the inherent noise pulse in the P-M tube, it is not feasible for clinical use, especially if a multiple detector unit is contemplated. An alternative is the use of a coincidence method of discrimination. This has proved to be quite satisfactory.

A scintillation counter has also been adapted for use in a brain needle probe to be used in studies of the direct localization of brain tumors by reason of their preferentially high uptake of P^{32} as described by Selverstone.[4] This instrument has the advantage of great stability and of being less sensitive to physical shock.

At present it would seem that the high efficiency and the physical aspects of scintillation counters which should allow attainment of excellent directivity with a minimal amount of shielding are worthy of further efforts to adapt them to clinical uses.

TABLE V

EXCERPT OF I^{131} PROTEIN TEST DONE OCTOBER 5, 1950, COUNTED ON OCTOBER 7, 1950

(69 μc. I^{131} protein given intravenously)*

Position	Side	Counts per Minute	Differential
(1) Forehead	R	388	R—2%
	L	379	
(2) Temporal	L	383	L—5%
	R	364	
(3) Frontal (45°)	R	364	
	L	414	L—12%†
(4) Frontal (top)	L	412	L—20%
	R	402	
(5) Earline (lat.)	R	331	
	L	405	L—18%†
(6) Earline (45°)	L	398	L—9%
	R	354	
(7) Earline (top)	R	361	
	L	496	L—21%†

* Multiple meningioma removed from left frontoparietal region.

† Site of tumors.

DISCUSSION

Sodium fluorescein has proved to be a simple reliable aid for the identification and localization of brain tumors at operation. In general, the degree of fluorescence parallels the degree of malignancy of the tumor. The affinity of fluorescein for tumor tissue is not specific. The success of the method seems to depend upon the absence of the so-called blood-brain barrier in the tumor vessels. Other lesions, such as brain abscesses, in which the barrier is disrupted

will also allow the dye to accumulate in such lesions but usually to a lesser extent.

Similarly radioactive diiodofluorescein has been used for the preoperative localization of brain tumors. The radioactive dye test is still not sufficiently accurate for use as a sole diagnostic agent. Its value as a supplementary procedure, however, is considerable. Ashkenazy and his colleagues[1] have reported a 92 per cent focal accuracy in the study of 340 patients suspected of having central nervous system tumors. Only one false positive diagnosis was made. They found that the precise localization could be obtained. In the same group of patients, pneumography was only 63 per cent focally accurate and electroencephalography was 45 per cent focally accurate. Ashkenazy also made the interesting observation that if the radioactive dye test was performed after subjecting the tumor to deep roentgen therapy, a higher concentration of dye was found in the tumor.

The limitations of the radioactive diiodofluorescein test are both biological and physical. There will always be a certain number of tumors with an inadequate "uptake" of dye and others of insufficient size for detection with this method.

Improved instrumentation should increase the validity of the test as performed at this clinic. In this regard, the possibility of utilizing scintillation counters has been mentioned.

The value of using radioactive diiodofluorescein as a research tool should not be overlooked. For example, it has been previously mentioned that 70 per cent diodrast injected into the carotid artery may disrupt the blood-brain barrier. Investigation has revealed that patients who have previously been subjected to angiography and subsequently given radioactive dye show a 10 to 30 per cent increase in counting rate on the injected side.

CONCLUSIONS

(1) Sodium fluorescein has proved to be valuable clinically for the identification of brain tumor tissue at operation.

(2) In experimental animals, fluorescein has been used in studies of disruption of the blood-brain barrier.

(3) Radioactive diiodofluorescein can be used to localize brain tumors preoperatively, but at this clinic it has not been accurate enough to employ as the sole diagnostic test.

(4) Radioactive iodinated albumin and K^{42} have been used as tracer agents; their merits and disadvantages are briefly discussed.

(5) Improved instrumentation such as the adaptation of scintillation counters to clinical use should increase the validity of the radioactive dye test.

(6) Use of radioactive diiodofluorescein in experiments concerned with disruption of the blood-brain barrier is suggested.

University of Minnesota
Medical School
Minneapolis 14, Minn.

REFERENCES

1. ASHKENAZY, M. Personal communication.
2. MOORE, G. E., PEYTON, W. T., FRENCH, L. A., and WALKER, W. W. Clinical use of fluorescein in neurosurgery; localization of brain tumors. *J. Neurosurg.*, 1948, *5*, 392–398.
3. MOORE, G. E., KOHL, D. A., MARVIN, J. F., WANG, J. C., and CAUDILL, C. M. Biophysical studies of methods utilizing fluorescein and its derivatives to diagnose brain tumors. *Radiology*, 1950, *55*, 344–362.
4. SELVERSTONE, B., SWEET, W. H., and ROBINSON, C. V. Clinical use of radioactive phosphorous in surgery of brain tumors. *Ann. Surg.*, 1949, *130*, 643–651.
5. SELVERSTONE, B. Paper read at the Clinical Congress of the American College of Surgeons, October, 1950.
6. STORAASLI, J. P., KRIEGER, H., FRIEDELL, H. L., and HOLDEN, W. D. Use of radioactive iodinated plasma protein in study of blood volume. *Surg., Gynec. & Obst.*, 1950, *91*, 458–464.

DISCUSSION

DR. HENRY G. SCHWARTZ, St. Louis, Mo. When Dandy presented his work on ventriculography to the American Neurological Association in 1922, the critical comments made by some of his eminent neurosurgical colleagues might have forced a lesser man to run for cover. We all know that time and experience have

verified Dandy's enthusiastic claims and, as Dr. Moore has pointed out, ventriculography has become the greatest single contribution to the development of neurosurgery.

Today we have all listened to a thoughtful, well documented presentation of a technique which gives promise of adding another significant diagnostic procedure. The method depends for its success upon increased permeability of the blood-brain barrier, so that at the present time we cannot depend upon it in differentiating focal encephalitis from some of the more slowly growing gliomas. As time goes on, we may expect that Dr. Moore's group will, with the use of other, more highly selective dyes, be able to achieve even greater accuracy of interpretation.

One of the drawbacks to the method used by Ashkenazy has been the length of time required to run the test. Dr. Moore is using multiple scintillation counters, which should bring this technique into greater practical use.

The difficulties of recognizing small, deeply situated lesions by this method have been pointed out by Dr. Moore, so that one cannot yet say that air studies are outmoded.

The investigative potentialities of the technique have been touched upon only lightly. I am sure that, given more time, Dr. Moore would mention numerous extremely important problems on cerebrospinal fluid and brain edema, which are begging to be approached by his technique.

Reference to his experimental studies following injection of diodrast already serves to elucidate some of the trying experiences we all have had with angiography, and immediately suggests the use of this method to test various contrast media before using them on patients.

It has been a privilege to hear Dr. Moore's report on a fascinating new technique, of which the practical and experimental applications are so promising.

I would like to ask Dr. Moore how much difficulty he has had in localization of primarily cystic tumors.

Dr. M. Ashkenazy, Houston, Texas. Radioactive diiodofluorescein has been utilized in the study of 340 patients with the diagnosis of a space-occupying lesion of the central nervous system. The findings were correlated with the preoperative clinical diagnosis, with electroencephalography, pneumography, angiography, and with the surgical and autopsy findings. Postoperative and postirradiation tests were made, and all of these studies were then correlated with the histopathological characteristics of the tumors.

The results indicate that this radiodye test is a very valuable diagnostic adjunct in neurosurgical problems, not only because of its high degree of accuracy in determining the presence of brain tumors, but also because of its relatively precise focal localization. The possibility of prognosticating in a general fashion the relative degree of cellularity and vascularity of the tumor also appears to be feasible.

In 340 patients suspected of having central nervous system tumors, studied by means of radioactive diiodofluorescein, the results reveal a 92 per cent accuracy in lesions verified by surgery or corroborated by pneumography or angiography. The technique is simple, and instrumentation consists of a Geiger-Müller tube, a counting-rate meter, and mechanical graphic recorder. The histopathologically verified lesions of the central nervous system included gliomas, meningiomas, metastatic carcinomas and sarcomas, pituitary tumors, spinal cord tumors, cerebellar hemangioblastomas, acoustic neurinomas, subdural hematomas, granulomatous cysts, and cerebral abscesses.

The affinity of radiodye for tumor tissue is related to the cellular and vascular pattern of the tumor. The more malignant the neoplasm, the greater is the radiofluorescein concentration. There is relatively little or no concentration of dye over the sites of large cysts or chronic subdural hematomas.

The negative findings also proved to be 95 per cent accurate and are of equal importance in the differential diagnosis of cerebral neoplasms, especially from such lesions as hypertensive cerebrovascular accidents, perichiasmal arachnoiditis, meningovascular syphilis, and ruptured intracranial aneurysms, especially in those patients with papilledema or jacksonian epilepsy.

Localization proved to be much more precise than with electroencephalography, or pneumography, whenever verification was obtained at surgery or at autopsy. Pneumography was 63 per cent focally accurate, and electroencephalography was only 45 per cent focally accurate. Tumor recurrences can be demonstrated readily with this technique. Postoperative deep radiation therapy caused an increased concentration of radioactive diiodofluorescein in the more

malignant intracerebral neoplasms. Special techniques of counting have been evolved, so that the accuracy of localizing midline tumors, such as those of the pituitary, brain stem, or posterior fossa, is as great as that of localizing the more superficially situated cerebral neoplasms.

With the apparatus and technique described in the slides which I have presented, the limitations of the test have proved to be very few, if due regard is had to accurate consistent placement of the Geiger tube on the skull, and if suspicious areas are rechecked and compared to symmetrical and adjacent areas of the skull. Space-occupying lesions in every area of the skull have been localized accurately.

We believe that the radioactive diiodofluorescein tracer test is a simple, safe, painless and reliable method for the diagnosis and localization of brain tumors, and one which should grow in value as increasingly more sensitive detection equipment, and more specific radioactive dyes become available.

Dr. Moore (closing). With all new procedures of diagnostic types, I think time is the final arbitrator as to whether they are worth while or not. In this instance we have had difficulty in localizing small brain tumors, especially small tumors of the cerebellum which consist of a cyst with a small mural nodule. We have also been unable to localize many of the pituitary tumors, since they contain very little dye, and with our instrumentation, at least, have not been diagnosed. All such things will have to await further study.

Dr. Ashkenazy is to be congratulated for his further development of the technique and his excellent study from a physical standpoint of all these different factors.

Vol. 66, No. 1

THE ROENTGEN AND DIFFERENTIAL DIAGNOSIS OF CHRONIC COR PULMONALE*

By MATTHEW O. MARKS, M.D.,
WOOSTER, OHIO
and
H. A. ZIMMERMAN, M.D.
CLEVELAND, OHIO

THIS paper is the second in a series of three recent articles from Cleveland City Hospital dealing with chronic cor pulmonale. The first was an attempt to correlate the clinical and autopsy findings.[21] This one is to deal essentially with the roentgen findings, and since the problem of differential diagnosis of an enlarged pulmonary conus and main pulmonary artery has frequently arisen in this connection, an attempt will be made to discuss this question also. The third paper in this series on chronic cor pulmonale will deal with the physiological findings on patients studied by cardiac catheterization.

Clinically, the diagnosis of cor pulmonale in the compensated patient is at best a difficult one, mainly because the physical findings are masked by the accompanying emphysema. An air cushion is provided between the heart and anterior chest wall so that the precordium and pulmonary conus become inaccessible. The heart sounds are distant and the pulmonic second sound may not seem particularly loud.

In the decompensated patient, the clinical diagnosis is still at times difficult, as emphysema alone will produce dyspnea and displace the normal liver downward to make it palpable. Peripheral vascular disturbances may be present to give ankle edema. Therefore, as a rule, until the patient having cor pulmonale is in advanced decompensation the clinical diagnosis may not be made easily.

MATERIAL FOR STUDY

The authors' interests were first stimulated in the problem of cor pulmonale by the report of Scott and Garvin[18] of 50 cases proved by autopsy during the years 1931–1940 at Cleveland City Hospital. These workers believed that the high incidence of cor pulmonale at this hospital was due to the higher percentage of immigrants from Southeastern Europe in Cleveland (9.5 per cent) than in the other large cities of the country. In their group of cases, 48 patients had some type of lung disease, of which 46 had emphysema alone or emphysema with bronchiectasis, silicosis, and/or tuberculosis. In 10 out of 19 of their patients who were studied by roentgen examination the radiologist reported enlargement of the pulmonary conus or the body of the right ventricle. In a recent review of 52 additional cases proved by autopsy at City Hospital from 1940 to 1947, reported in detail by Zimmerman, Ryan and Scott,[21] it has been found that in only 9 cases out of 39 was the correct diagnosis made by roentgen examination. It should be pointed out, however, that many of these patients were desperately ill on admission and complete roentgenoscopic and roentgenographic studies could not be made. The diagnosis was suggested in an additional 6 patients who had only a single chest roentgenogram in the posteroanterior projection.

An analysis of the reasons for failure in making this diagnosis by roentgen study prior to 1947 shows that the reasons were:

1. Lack of roentgenoscopic examination. This omission was usually due to the fact that the patient was too ill to stand comfortably, and examination in the recumbent position is certainly of doubtful value.

* Departments of Radiology and the Cardiovascular Laboratory, Cleveland City Hospital, Western Reserve University School of Medicine, Cleveland, Ohio.

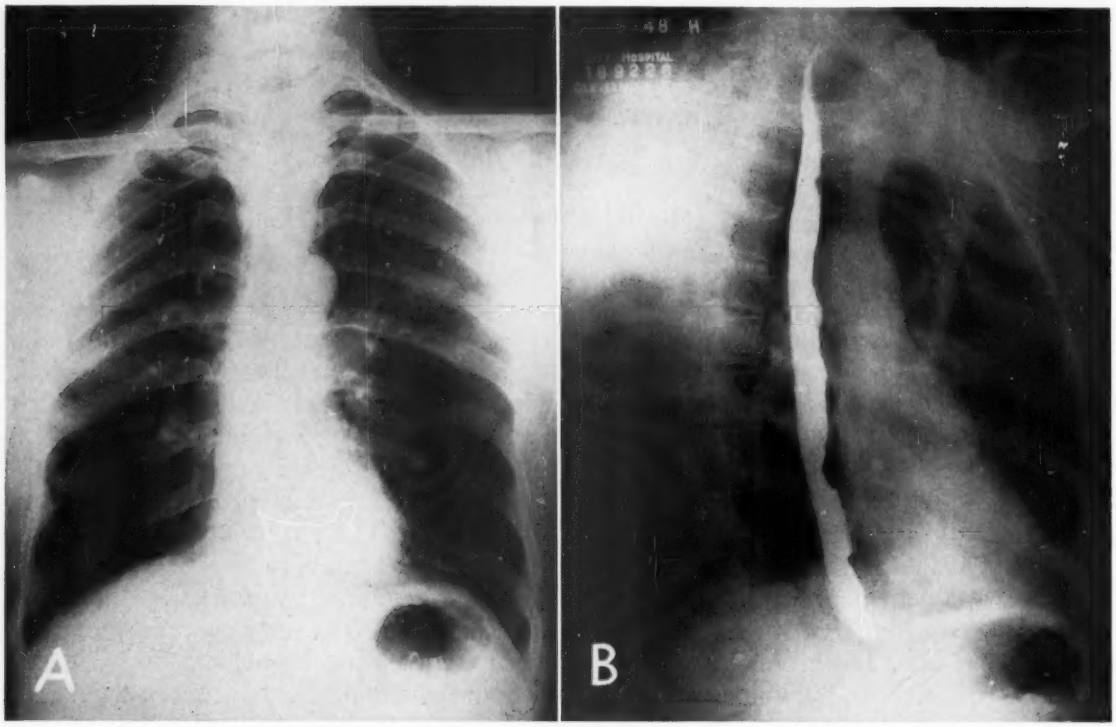

Fig. 1. (*A*) The normal appearance of the cardiac shadow in a posteroanterior chest roentgenogram of a patient with cor pulmonale, proved by autopsy. (*B*) The necessity of a right anterior oblique view is demonstrated. The pulmonary conus is prominent. Same patient and same day as (*A*).

2. Lack of roentgenograms in both oblique positions as well as the posteroanterior projection. When only the posteroanterior view was available, the configuration of the heart was completely normal surprisingly often (Fig. 1, *A* and *B*). This is in agreement with the findings of Parkinson and Hoyle.[13]

3. The presence of extensive pulmonary disease which obscures the cardiac borders in both the posteroanterior and oblique positions (Fig. 2).

After review of these cases, however, it is believed that some of them should have been diagnosed correctly.

PATHOLOGICAL FINDINGS

The most frequently used basis for the pathological diagnosis of cor pulmonale in this series is a right ventricle which measures 5 mm. or more in thickness when measured 2 cm. below the pulmonic valve, in the region of the conus.[12] More important than just the thickness of the ventricular wall, however, is the weight of each ventricle, and for this reason a few of the hearts in this series were studied by using a modification of the technique described by Herrmann and Wilson.[9,10] Briefly, this technique consists of dissection of all the fat, the valves, and separation of the ventricular muscle fibers into those of the left and right ventricles.

Lewis[11] originally determined the average normal ratio between the weights of the left and right ventricles (hereafter referred to as the L/R ratio) to be 1.8, with a variation of from 1.47 to 2.06. Herrmann and Wilson[9] modified his technique slightly and found that the normal L/R ratio varied from 1.46 to 2.14. They recommend that the figures of 1.5 and 2.2 be taken as the limits of normal for all practical purposes. In other words, when the L/R ratio falls below 1.5, an interpretation of abnormal right ventricular preponderance is given. They have called a ratio from 1.5 to 1.78 "right ven-

tricular within normal limits." A ratio of 1.3 is necessary before the diagnosis can be made, according to Clawson.[3]

The absolute weights of the ventricles may be used also as criteria for making the diagnosis of cor pulmonale. The right ventricle, when sectioned at City Hospital, usually weighs more than 100 grams in the case of cor pulmonale, while the left ventricle weighs 100–120 grams normally. The columnae carnae are extremely well developed throughout the right ventricle. Both the pulmonic and tricuspid valves are dilated.[12]

All patients with valvular or congenital heart disease were automatically excluded, regardless of the thickness of the wall of the right ventricle. Any patient with significant coronary artery disease was likewise excluded. No patient with significant vascular disease of the kidneys was included, as it was realized that hypertension could not be ruled out as a cause for the right ventricular hypertrophy in these cases.

ROENTGEN FINDINGS

The problem of the radiologist is to demonstrate right ventricular hypertrophy without significant enlargement of the left atrium or ventricle in a patient who has no history or objective evidence of hypertension, who has no good evidence of significant coronary artery disease, and who probably has moderate to severe emphysema with or without other chronic pulmonary disease. The patient may give a history of long-standing bronchial asthma. Recently there have been reports of patients with pulmonary beryllium granulomatosis dying of chronic cor pulmonale.[5] It is evident that there must be close cooperation between the clinician and the radiologist.

During roentgenoscopy and on subsequent roentgenograms the following findings are searched for carefully:

1. *In the posteroanterior position* (Fig. 3*A*) there is (a) a bulge in the region of the main pulmonary artery, as seen along the left cardiac border below the aortic

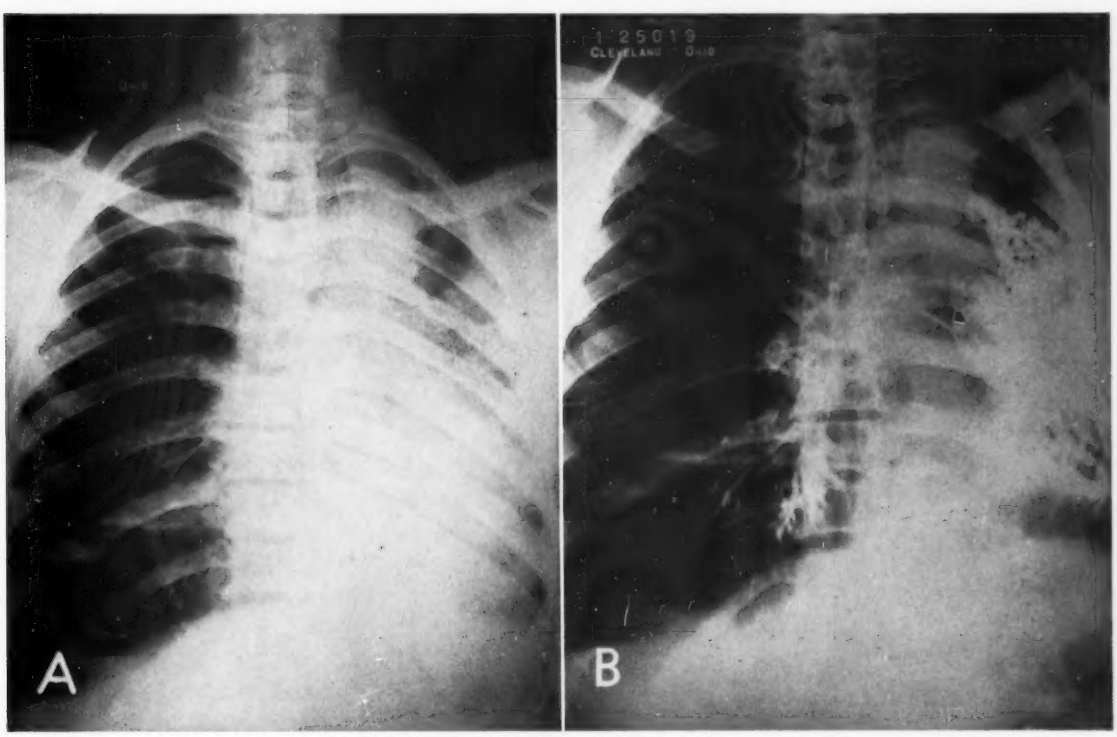

Fig. 2. (*A*) and (*B*) The diagnosis of cor pulmonale proved by autopsy was obscured by the extensive bronchiectasis and retraction of the left lung. Other views, not shown here, were similar.

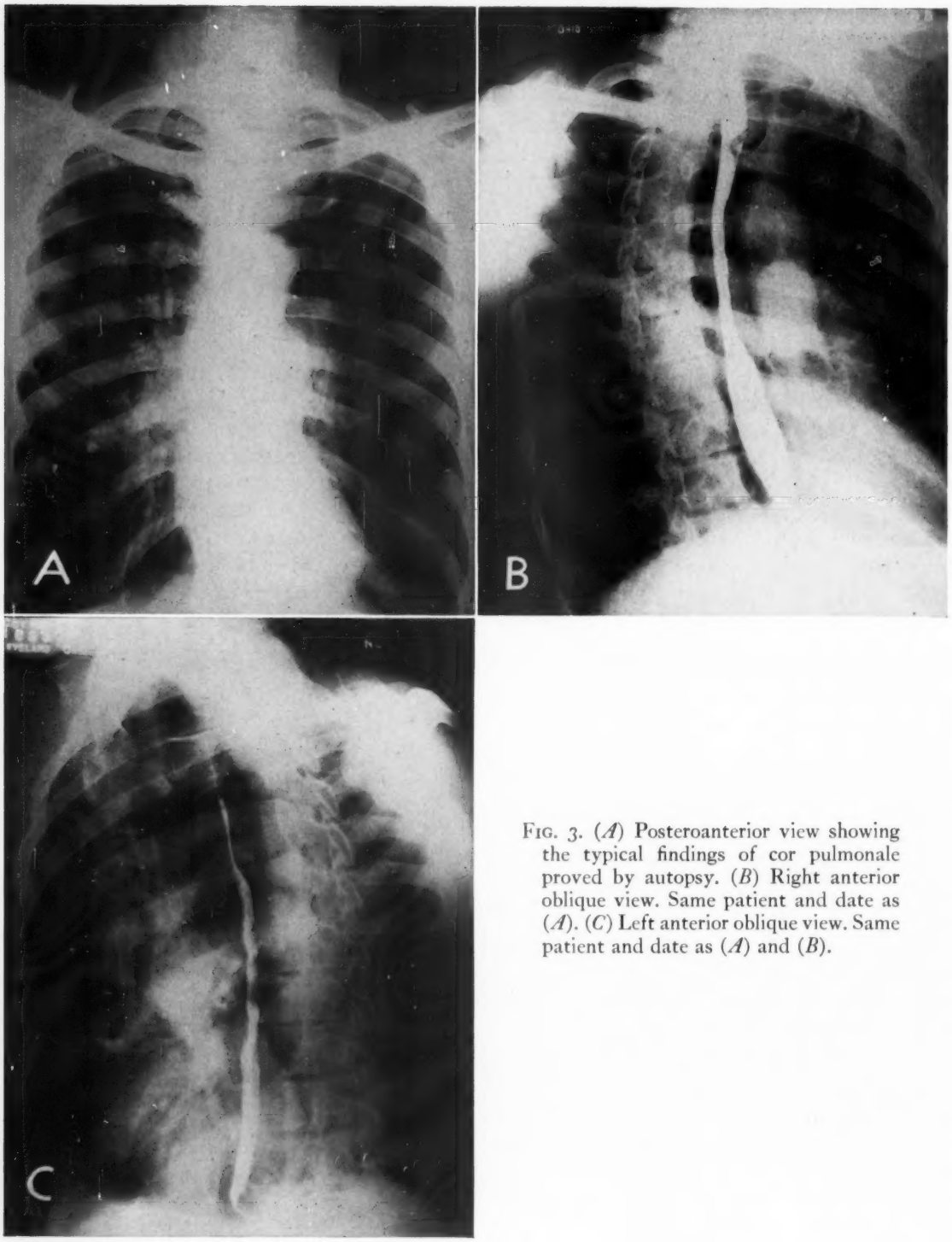

Fig. 3. (*A*) Posteroanterior view showing the typical findings of cor pulmonale proved by autopsy. (*B*) Right anterior oblique view. Same patient and date as (*A*). (*C*) Left anterior oblique view. Same patient and date as (*A*) and (*B*).

knob. This varies greatly in prominence. However, there is usually a definite notch below this segment in contradistinction to the heart of mitral stenosis, in which the left auricular appendage becomes prominent, obliterates this notch, and straightens the left cardiac border to a greater extent or even produces a convexity in this region.

(b) A widening of the heart shadow in the region of the conus, i.e., in the upper and middle portions of the cardiac silhouette. (This finding is demonstrated progressively in Fig. 4.) This finding is verified during roentgenoscopy by a downward displacement of the point of opposite pulsations.

(c) Each hilus is prominent due to the enlarged pulmonary arteries. Clerc and Mourrut[4] have used the term "moustache" to describe the enlarged and dense contour of the lower branch of the right pulmonary artery in cor pulmonale, but we are of the opinion of Robb and Steinberg[16] that the pulmonary arteries in cor pulmonale are usually not of sufficient size to merit this term. During roentgenoscopy their pulsations are of increased amplitude though they are seldom of such a forceful nature as is seen in certain types of congenital heart disease.

(d) Pulmonary emphysema is usually present and is demonstrated by an increased radiability of the lung fields, widening of the intercostal spaces, and depression of both leaves of the diaphragm with poor excursion.

(e) The transverse cardiac diameter need not be increased. In fact, if the patient does not have cardiac failure, enlargement should not be expected.

2. *In the right anterior oblique position* (Fig. 3*B*) (a) the conus is seen best and bulges anteriorly. This region of the outflow tract always enlarges before the inflow tract does.[19]

(b) A sign which has been emphasized only seldom in the past is the greatly increased oval density of the pulmonary trunk at its bifurcation into left and right pulmonary arteries, with the latter clearly seen in this position. Although it is admitted that this greater density is due partially to the greater contrast possible with the overlying emphysematous lungs, the authors believe it is also due to the increased pressure and blood flow in the pulmonary arteries.

(c) Encroachment upon the retrosternal space by the heart. The authors and others[13] have preferred to use the left anterior oblique view to demonstrate this finding, for as Sussman[14] has pointed out by angiocardiographic tracings, the left ventricle normally makes up a large segment of the anterior border in the right oblique view so that with enlargement of either ventricle or a combination of the two ventricles the retrosternal space may be narrowed in this view.

(d) Lack of significant displacement of the barium-filled esophagus in the region of the left atrium. In fact, the course of the esophagus is frequently very straight and almost vertical distal to the aortic impression.

3. *In the left anterior oblique position* (Fig. 3*C*) (a) with the patient rotated at least 65 degrees, the enlarged right ventricle encroaches upon the retrosternal space since it is the chamber located anteriorly in this projection. At the same time, it can be seen that the left ventricle is not significantly displaced over the spine. The diaphragmatic surface of the heart is increased.

(b) The interventricular groove which is displaced posteriorly and upward may be seen without difficulty at times because of the low position of the diaphragm.

(c) The greatly increased circular density at the bifurcation of the pulmonary trunk, described in the right anterior oblique view, may also be seen in this position. Here, however, the left pulmonary artery is the one seen well distal to the bifurcation.

DIFFERENTIAL DIAGNOSIS OF AN ENLARGED RIGHT VENTRICLE, CONUS, AND PULMONARY TRUNK

After one has demonstrated the presence

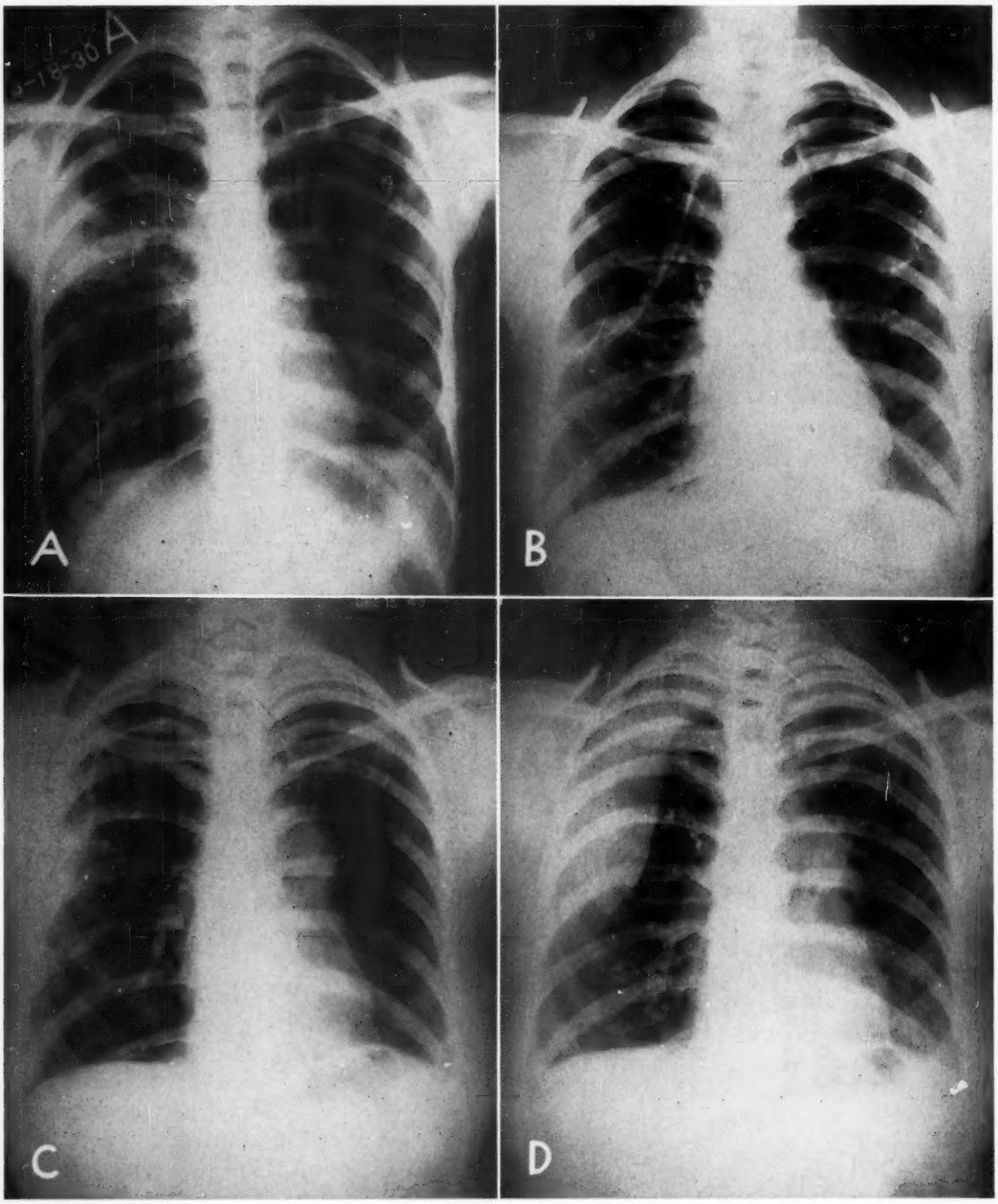

Fig. 4. (*A*) March 18, 1930. Initial diagnosis of far advanced pulmonary tuberculosis. Note width of conus region. (*B*) July 15, 1939. Artificial pneumothorax was instituted in 1930 and has been maintained. Region of conus is broader now. Re-expansion was started shortly after this time. (*C*) December 15, 1943. Left lung completely re-expanded and right lung partially re-expanded. Conus now much larger. (*D*) November 7, 1946. Bilateral re-expansion with pleural thickening, right. The patient died about six months later of cor pulmonale, proved by autopsy.

of an enlarged pulmonary conus with or without enlargement of the body of the right ventricle, the question is frequently asked, "Is this cor pulmonale or some other condition which may give similar findings?" This question is one which may be extremely difficult to answer at times. Emphasis should be placed here on the fact that the task of both the radiologist and the clinician is made easier by a mutual understanding of the problem at hand.

As an example, the internist or cardiologist may see a patient who is past fifty, who gives a history of progressive shortness of breath, who has considerable emphysema and no audible murmurs. Since the diagnosis of either coronary artery sclerosis or cor pulmonale may be one of exclusion, the radiologist may be of great help to the clinican by demonstrating selective hypertrophy of the conus or the right ventricle, for in coronary artery disease both ventricles should be enlarged if hypertrophy is present at all. Coronary calcification demonstrable by roentgen methods should not be seen in cor pulmonale.

On the other hand, the radiologist may see an enlarged pulmonary conus with or without a large right ventricle and be unable to determine its etiology without the information concerning the complete history and physical findings which the clinician may be able to furnish.

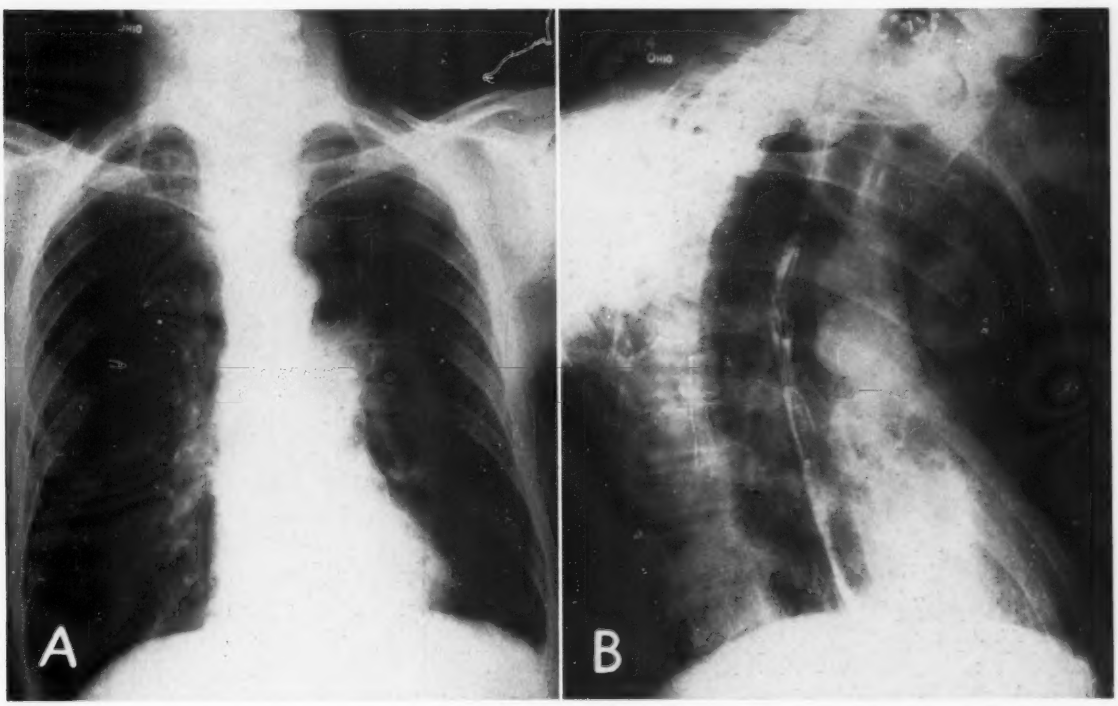

Fig. 5. (*A*) and (*B*) Recent case of cor pulmonale, proved by cardiac catheterization.

Roesler[17] and Schwedel[19] have stated that the exact anatomical boundary between the pulmonary conus and the main pulmonary trunk cannot be located and that if one is enlarged then the other will be prominent also. During systole they actually function as one unit, and it is only during diastole that their physiological difference is made known, when the pulmonary artery maintains the diastolic pressure within the lung and the conus acts as a part of the right ventricle.

With the advent of improved techniques in cardiac catheterization studies, an etiologic antemortem diagnosis of the enlarged pulmonary conus may be made more

surely (Fig. 5.) Where autopsy proof is lacking for any group of roentgenograms reproduced in this paper, proof by catheterization has been accepted.

1. *Congenital Heart Disease.*

(a) *Interatrial septal defect* (Fig. 6). The clinical findings are quite varied. In fact, the history and physical examination may be entirely normal and the first clew of heart disease may come from the radiologist who reports an enlarged heart with a prominent pulmonary conus. On the other hand, a loud systolic murmur may be heard over the base of the heart. A thrill is seldom felt. The pulmonic second sound as a rule is accentuated.

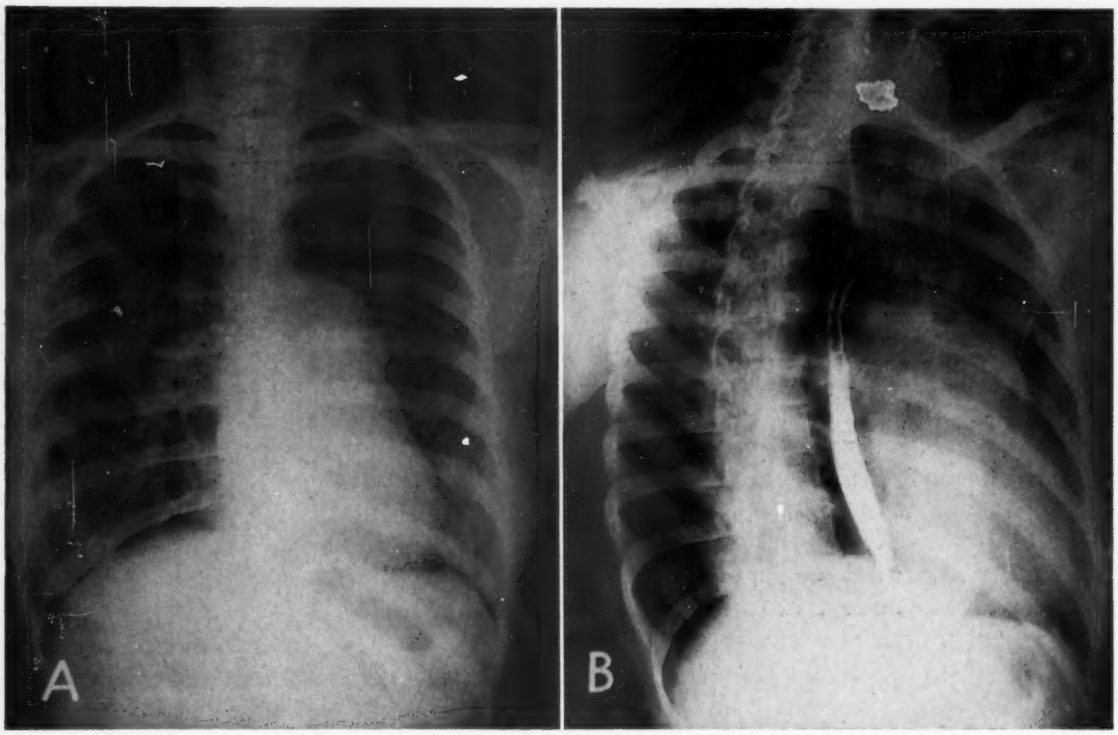

Fig. 6. (*A*) and (*B*) Atrial septal defect. Proved by cardiac catheterization.

One roentgenoscopic finding which has been popularized is the presence of a "hilar dance." We would like to point out, however, that such prominent pulsations may occur also in a high interventricular defect, Eisenmenger's complex, and Lutembacher's syndrome. Patent ductus arteriosus and diffuse sclerosis of the pulmonary arterioles may also produce a "hilar dance."[7] In such conditions as cor pulmonale and thyroid heart disease, the pulsations of the pulmonary arteries are of increased amplitude but a true "hilar dance" is usually not seen.

Both the right ventricle and atrium are enlarged, although the latter may be difficult to demonstrate, possibly because of forward rotation.[2] The aorta is small. The right pulmonary artery is seen especially prominently, and its appearance has given rise to the term of "comma sign." This condition is much more likely to produce the "moustache" described by Clerc and Mourrut[4] than is cor pulmonale, in our experience.

It has been said that the appearance of the interatrial septal defect in the right anterior oblique position has a characteristic rectangular appearance. It should be pointed out that this may be misleading, however, for there are several other lesions, particularly in the group of con-

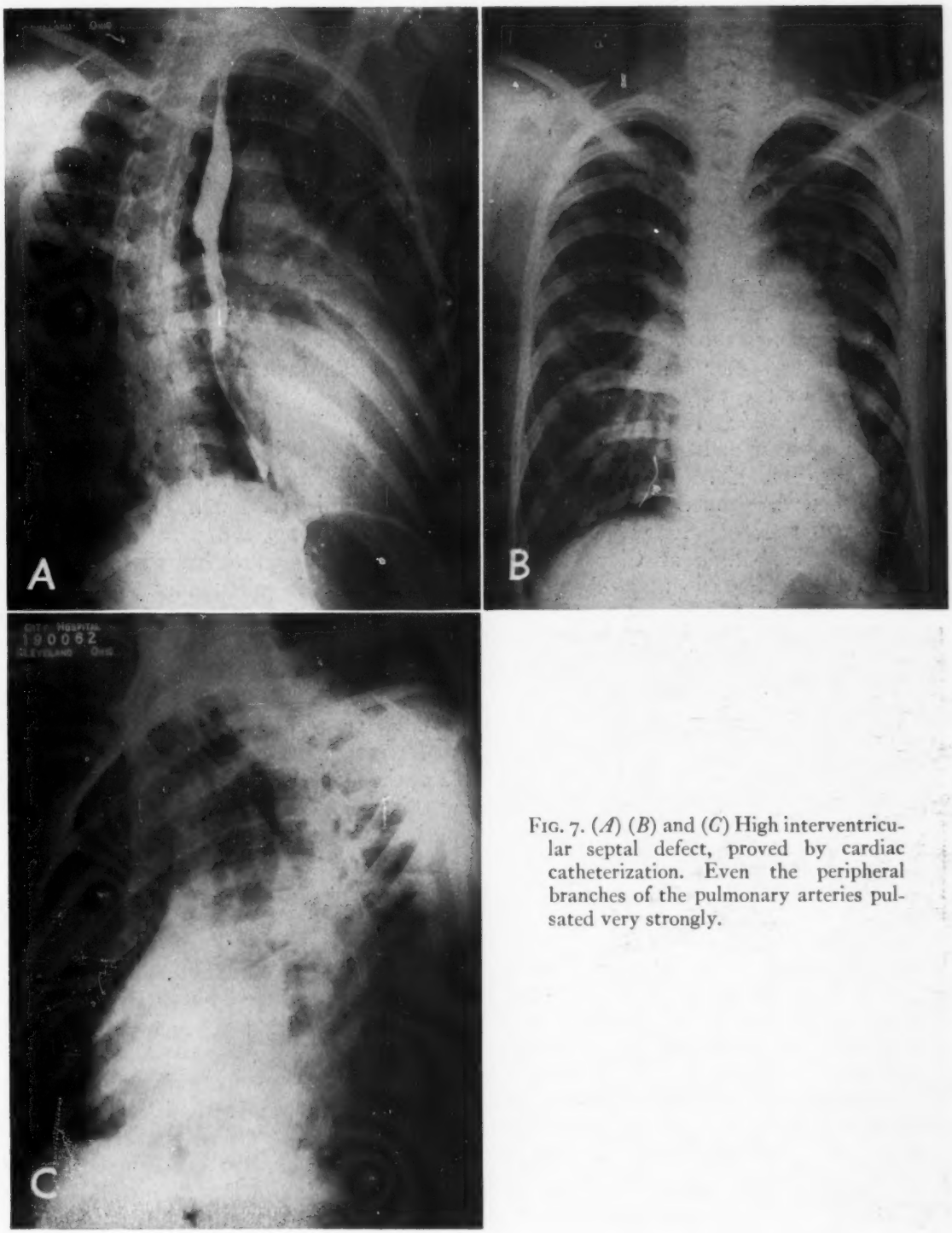

Fig. 7. (*A*) (*B*) and (*C*) High interventricular septal defect, proved by cardiac catheterization. Even the peripheral branches of the pulmonary arteries pulsated very strongly.

genital anomalies, in which the heart may assume these contours. Bedford, Papp and Parkinson[2] have reported 53 cases as atrial septal defect, but only 10 of these were proved by autopsy. They admit that the diagnosis in some of these cases was based on "probability," since pulmonary hypertension is "so rare" and an atrial septal defect so common. Experience at City Hospital has shown the exact opposite to be true. We do not think that the diagnosis of this congenital defect is so typical that it can be made in a large group of cases without some degree of error. These errors have been shown by recent techniques of intracardiac catheterization.

The age of the patient with an atrial septal defect, which is more common in women, may be of no help in differentiating from cor pulmonale. Recently an interatrial defect was proved by cardiac catheterization of a seventy-five year old woman in the Cardiac Clinic at City Hospital. The electrocardiogram may show right axis deviation in either condition. East and Bain[7] have stated that this finding is not present in more than one-third of the cases of cor pulmonale, however.

Fig. 8. Patent ductus arteriosus. Proved by surgery. The pulmonary conus and artery are often more prominent than seen here.

(b) *Lutembacher's syndrome.* The physical signs are those of mitral stenosis and atrial septal defect. The paradoxical roentgen finding of a left atrium of normal size in a patient with definite mitral stenosis clinically should lead one to make this diagnosis. The left atrium actually does not become enlarged because of the shunt of its blood into the right atrium. The pulmonary conus is usually much more prominent than in the pure mitral stenosis. The electrocardiogram shows right axis deviation.

(c) *High interventricular defect.* The typical signs of an interventricular defect are a palpable thrill with a harsh systolic murmur which is localizable to the third or fourth interspace just to the left of the sternum. As a rule, the heart is only slightly enlarged. It is when this septal defect becomes very large that the problem arises for the radiologist, for in these instances a large amount of blood is pumped almost directly from the left ventricle into the pulmonary trunk. Hence, the conus and trunk may assume a very large size.[20] In fact, the largest branches of the pulmonary arteries seen in this series were those of a patient with this diagnosis proved by intracardiac catherization (Fig. 7). He was not cyanotic.

The electrocardiogram is normal as a rule. However, with a large defect there may be right axis deviation. This diagnosis, then, is another example of the necessity of close cooperation between the clinician and the radiologist.

(d) *Patent ductus arteriosus* (Fig. 8). Clinically a patent ductus is characterized by a continuous murmur throughout both phases of the cardiac cycle, the systolic component being louder than the diastolic component. This murmur is characteristically described as a machinery murmur and is localized in the second left intercostal space between the edge of the sternum and

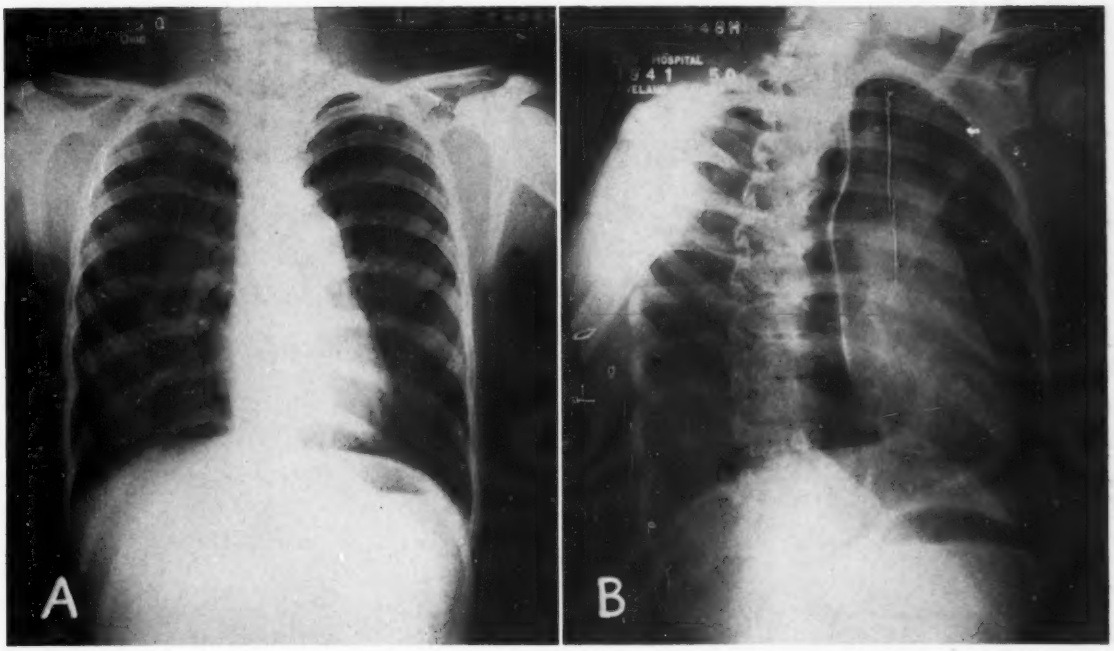

Fig. 9. (*A*) and (*B*) Pulmonic stenosis, proved by cardiac catheterization. The pulmonary vessels are small.

the mid-clavicular line. A systolic thrill may be present in this area. The pulmonic closure is loud and accentuated. The pulse pressure is wide, and on exercise the diastolic phase falls to an even lower level.

The contour of the heart, as viewed by the radiologist, is quite variable. It may be entirely normal or the segment of the pulmonary artery may be greatly enlarged. Hilus pulsations may be quite prominent and the lung markings may be increased. Depending on the size of the shunt, the left ventricle may be enlarged and the electrocardiogram may show signs of left ventricular strain. Occasionally right axis deviation is present but usually the electrocardiogram is normal.[20] The best gauge of the size of the ductus is the size of the pulmonary artery and blood pressure readings rather than the intensity of the murmur and thrill.[8] Other congenital lesions have been found in two-thirds of all cases of patent ductus arteriosus.[17]

(e) *Eisenmenger's complex.* The tetralogy of Eisenmenger, a very rare condition, is made up of (1) an interventricular septal defect, (2) right ventricular hypertrophy, (3) overriding of the aorta, and (4) dilatation of the pulmonary artery. It differs from the tetralogy of Fallot in that the latter condition includes pulmonary stenosis and hypoplasia of the pulmonary artery rather than dilatation.

The clinical picture is one of cyanosis, decreased exercise tolerance, and physical signs of right ventricular enlargement. A systolic murmur and thrill are present over the base of the heart. P_2 is usually normal or accentuated. The electrocardiogram shows right axis deviation. This defect is seen one-twentieth as often as the tetralogy of Fallot.

The roentgenographic appearance depends upon the prominence of the pulmonary conus and main pulmonary artery, which are in direct relation to the size of the interventricular defect. As previously stated, the hila may pulsate prominently. Both ventricles are likely to be enlarged.

In contrast to an isolated interventricular septal defect, the oxygen saturation of the systemic arterial blood is lower than normal. This accounts for the cyanosis, assuming that there is enough reduced hemo-

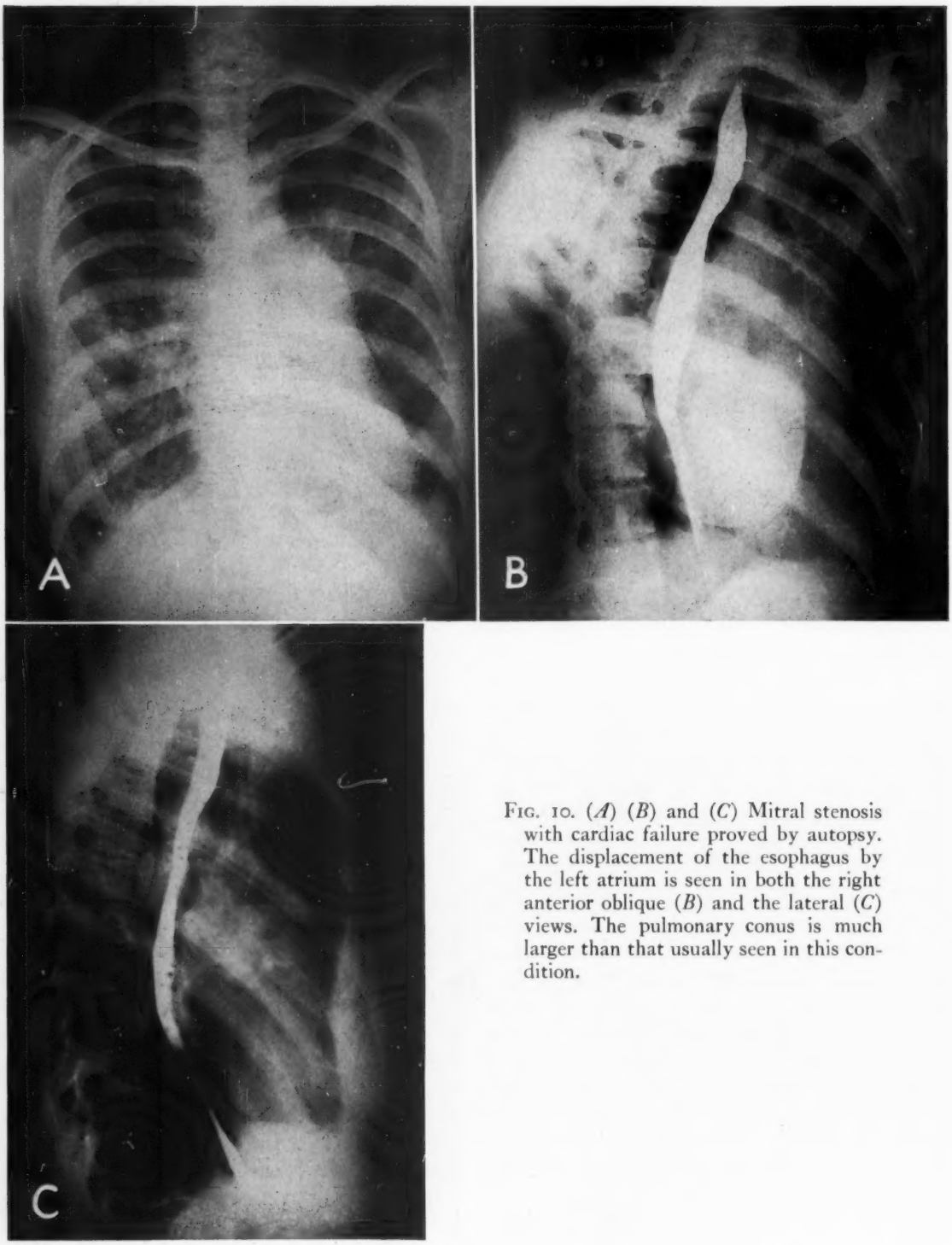

Fig. 10. (*A*) (*B*) and (*C*) Mitral stenosis with cardiac failure proved by autopsy. The displacement of the esophagus by the left atrium is seen in both the right anterior oblique (*B*) and the lateral (*C*) views. The pulmonary conus is much larger than that usually seen in this condition.

globin present. Blood samples from the femoral or brachial artery are taken at the time of cardiac catheterization and oxygen determinations are done.

(f) *Pulmonic stenosis* (Fig. 9). The clinical diagnosis of pulmonary stenosis is characterized by slight to moderate cyanosis. Exercise tolerance is reduced, as a rule, and severe dyspnea may be present. There is a loud systolic murmur and thrill localized to the pulmonic area. P_2 is greatly diminished or entirely absent.

Signs of right ventricular hypertrophy may be present, both clinically and by roentgen examination. The vascular markings in the lung fields are diminished. The conus may be quite prominent.

Post-stenotic dilatation of the pulmonary artery has been recorded well by angiocardiographic studies.

Stenosis of the pulmonary valve is quite rare as a single lesion. The accompanying malformation is most commonly an interventricular defect. "Infundibulum stenosis" is even rarer except when it exists as a part of the tetralogy of Fallot.

2. *Mitral Stenosis* (Fig. 10 and 11). Clinically, the diagnosis of mitral stenosis is not a difficult one in most instances.

The typical findings are signs of right ventricular hypertrophy, loud P_2, and a loud mitral first sound with a characteristic presystolic murmur which has been described as a "rumble." Auricular fibrillation is often present.

de Navasquez, Forbes and Holling[6] found that the L/R ratio of a group of "uncomplicated" cases of mitral stenosis averaged 1.0. Lewis[11] has reported L/R ratios as low as 0.50 in hearts showing mitral stenosis and regurgitation. He also includes a case of mitral regurgitation with a L/R ratio of 0.32, in which the right ventricle weighed 411 grams and the left ventricle 132 grams. These figures should serve to emphasize the enormous size of the right ventricle in some patients with rheumatic heart disease.

In addition to demonstrating the right ventricular enlargement, the radiologist is able to show left atrial enlargement by posterior displacement of the barium-filled

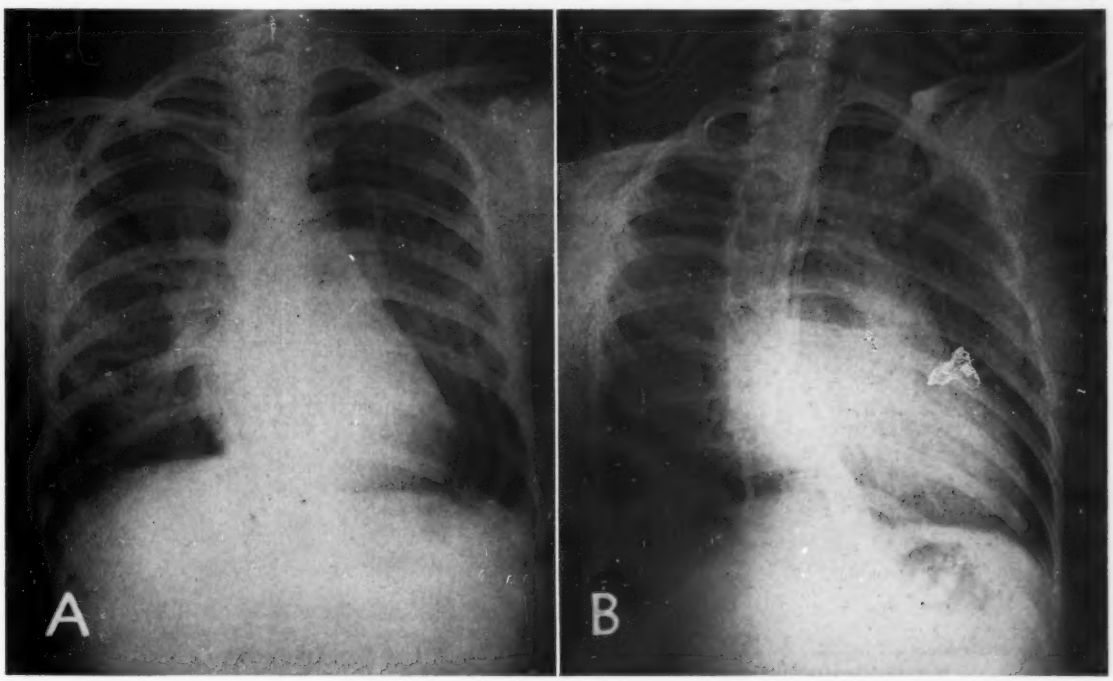

Fig. 11. (*A*) and (*B*) Mitral stenosis proved by autopsy. The findings in this examination are much more typical than those seen in Figure 10.

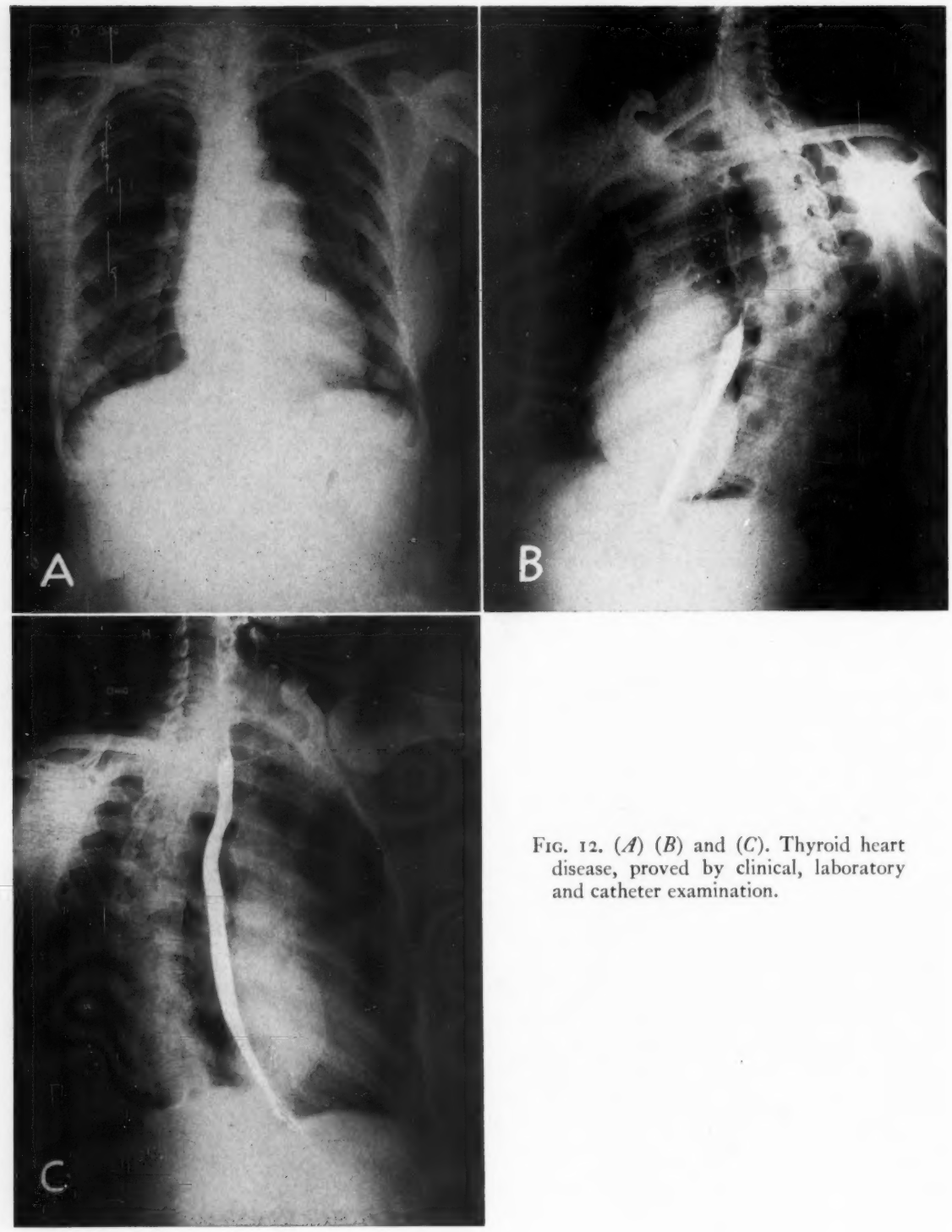

Fig. 12. (*A*) (*B*) and (*C*). Thyroid heart disease, proved by clinical, laboratory and catheter examination.

esophagus in the right anterior oblique or lateral view. This segment is located below the impression of the pulmonary artery and extends for a distance of about 6 to 12 cm., depending upon the extent of the enlargement. The main difficulty arises in a heart of large proportions, for the esophagus may be rather diffusely displaced posteriorly merely by sheer bulk of the heart. The left ventricle becomes enlarged only after regurgitation becomes a prominent feature[17] or when accompanying aortic stenosis is present.

The left cardiac border is much straighter than in the usual case of cor pulmonale since the enlarged left auricular appendage effaces the groove below the pulmonary artery segment.[17,19] The left atrium may assume such giant proportions that it becomes a part of the right cardiac border, producing a double contour at or near this point.

3. *Thyroid Heart Disease* (Fig. 12). The patient usually has such signs of hyperthyroidism as sweating, irritability, emotional instability, and weight loss in spite of an increased caloric intake. The cardiac findings consist of tachycardia, palpitation, and a heaving precordium with a dynamic abdominal aorta. The pulse pressure is wide. It is worth while noting that auricular fibrillation is a frequent accompaniment of this condition. Although the basal metabolic rate in cardiac failure may be as high as plus 35, in hyperthyroidism it is often greater. As a rule, the cholesterol blood level is low. The thyroid gland may or may not be palpable in the neck.

Although there is a tendency to generalized cardiac enlargement in this condition, the pulmonary trunk and right ventricle may be greatly dilated at times.[15] This is more likely the case in the patient with long-standing or severe hyperthyroidism.[7] As shown by catheter studies, this dilatation is due to an increase in blood flow rather than an increase in the pressure in the pulmonary circulation. However, as soon as failure intervenes the pulmonary arterial pressure increases. The pulsation of the conus and pulmonary arteries may be of increased amplitude and the rate will be rapid.

If the diagnosis remains in doubt, an increase in cardiac output may be demonstrated by catheter studies. In mitral stenosis the cardiac output is normal until failure supervenes, when it becomes diminished. The only type of congenital heart disease mentioned in this differential diagnosis which is accompanied by an increase in the cardiac output is a patent ductus arteriosus.

Robb and Steinberg[16] have included the myxedema heart as another possible cause for enlargement of the pulmonary conus and trunk.

4. *Cardiac Failure.* A clinical discussion of cardiac failure is not within the scope of this paper. However, it is important for the radiologist to realize that considerable dilatation of the pulmonary conus may be present just on the basis of cardiac failure, regardless of the etiology of the heart disease. All the chambers will probably be dilated if the patient is in frank failure, and it may be necessary for the radiologist to withhold his impression until re-examination can be carried out after the circulatory status has been improved. At this time the heart is much more likely to assume the contours characteristic for that particular disease. Other roentgen signs of cardiac failure consist of pleural effusion (usually more pronounced and appearing earlier on the right side), prominent hila, and an increased prominence of the vascular markings in both lung fields, particularly at the bases.

5. *Kyphoscoliosis.* By far the most common form of scoliosis of the thoracic spine is that with its convexity to the right. Because of this curvature, the heart is rotated to the left. As a result, the left cardiac border is straightened and the pulmonary conus is prominent even though no cardiac disease is present. For this reason, a diagnosis of true enlargement of the conus and trunk may be difficult. The clinician is also hampered by the inability to carry out a

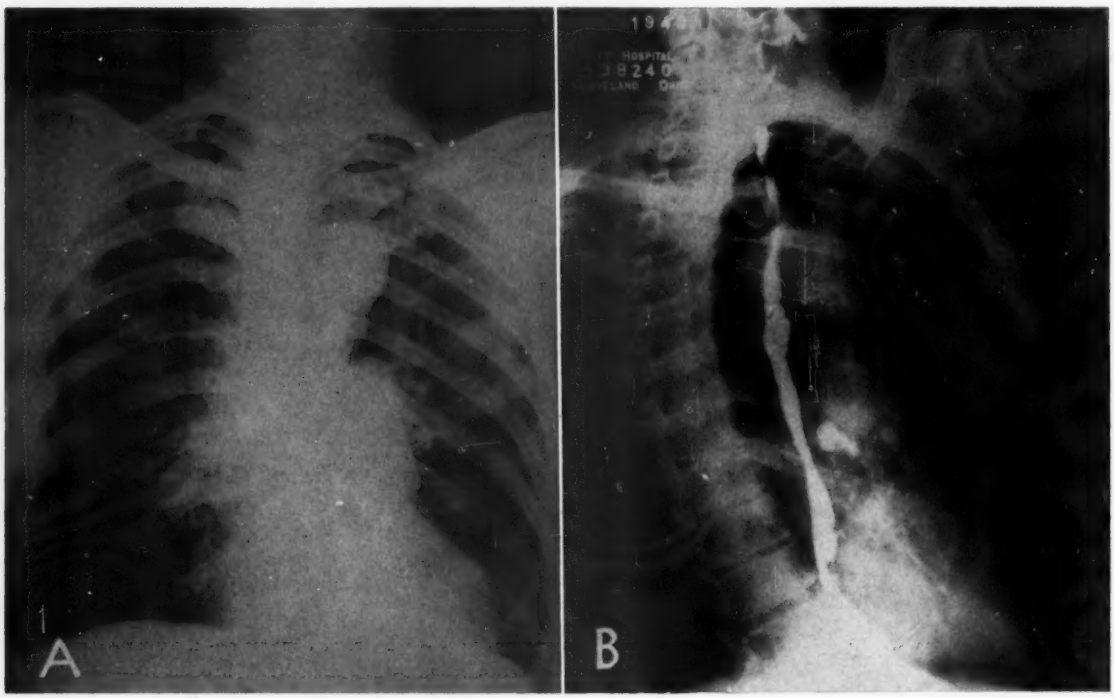

Fig. 13. (*A*) and (*B*) The roentgen findings were interpreted as representing cor pulmonale. However, after normal catheter studies, the appearance was ascribed to the habitus of the patient.

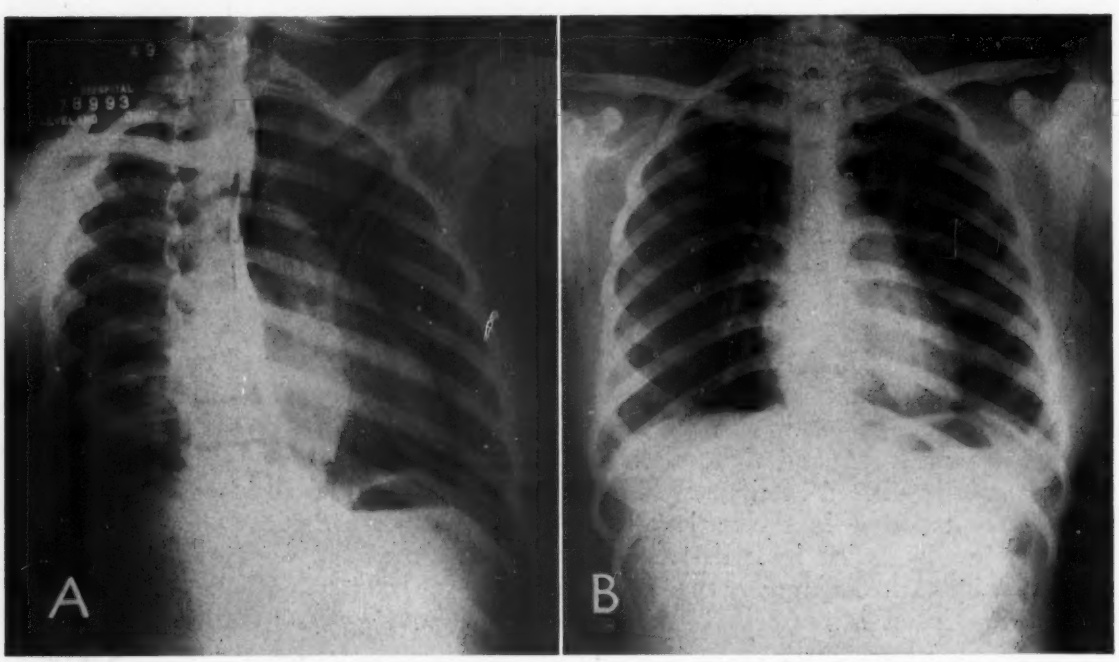

Fig. 14. (*A*) and (*B*) The slightly prominent conus is within normal limits, especially for a person of this age (sixteen). This fact was proved by catheterization studies.

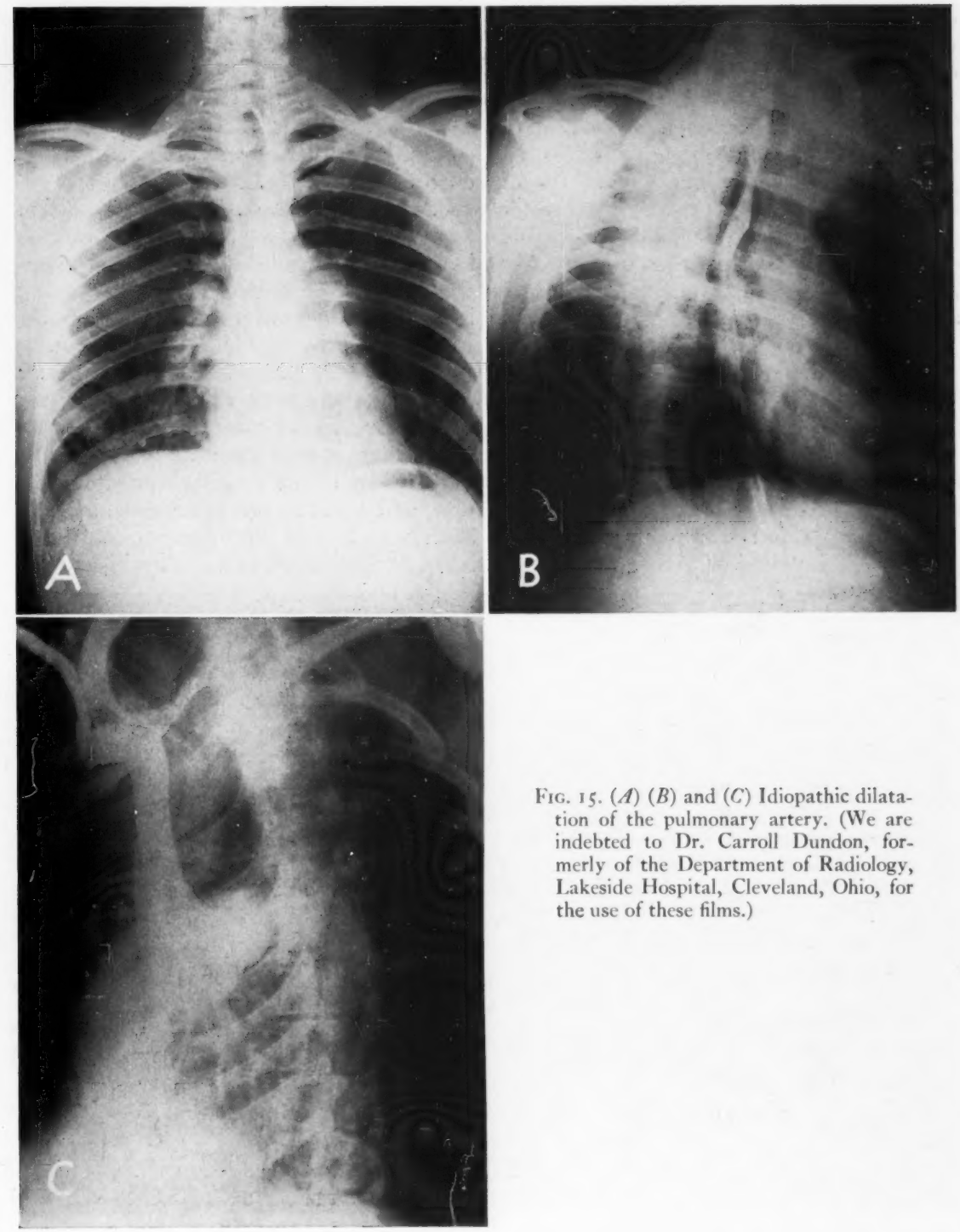

Fig. 15. (*A*) (*B*) and (*C*) Idiopathic dilatation of the pulmonary artery. (We are indebted to Dr. Carroll Dundon, formerly of the Department of Radiology, Lakeside Hospital, Cleveland, Ohio, for the use of these films.)

thorough physical examination. It is a known fact that "hunchbacks" may die of cor pulmonale and it is in these patients that the diagnosis becomes extremely difficult.

6. *Aneurysm of the Pulmonary Artery.* The only clinical finding may be that of accessibility of the pulmonary conus on physical examination. The true nature of the lesion is revealed usually only after roentgenoscopic and angiocardiographic examination. The pulsations are of greatly increased amplitude in the region of the aneurysmal dilatation.

7. *Age and Habitus of the Patient.* The person with the long, slender thoracic cage and the so-called "dropped heart" may make the diagnosis of cor pulmonale difficult. An example of this condition is seen in Figure 13. In this particular case the radiologist had suggested the diagnosis of cor pulmonale but catheter studies disproved this impression. An example of a young patient with a slightly prominent pulmonary conus is shown in Figure 14. On a routine chest survey this roentgenogram was interpreted as being within normal limits, if there were no signs or symptoms of cardiac disease. This statement was confirmed and the possibility of congenital heart disease was excluded by cardiac catheterization.

8. *Ayerza's Disease.* This rare condition may produce roentgen cardiac findings identical to cor pulmonale. It is due to endarteritis of the pulmonary arterioles and is usually differentiated by the extreme cyanosis and the absence of emphysema.

9. *Idiopathic Dilatation of the Pulmonary Artery.* This diagnosis would seem justified only after all the causes for an enlarged pulmonary artery have been reasonably excluded by clinical, roentgen, catheterization, and angiocardiographic examination. Such was the case of the patient whose roentgenograms are shown in Figure 15.

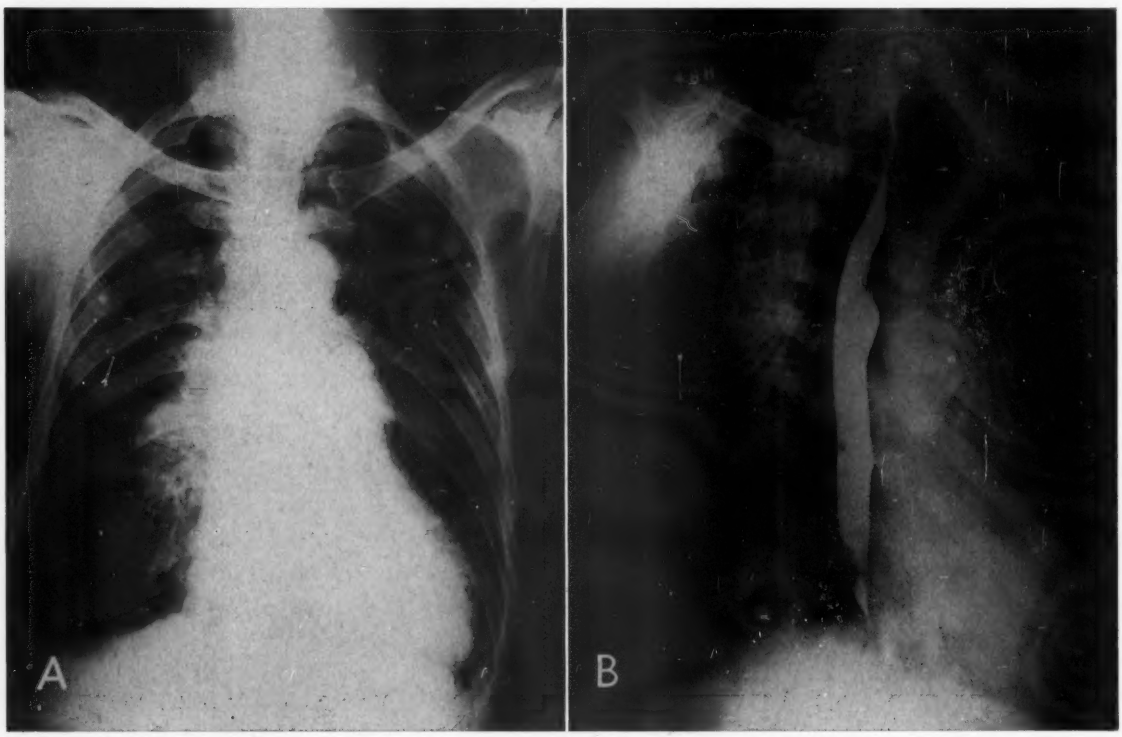

Fig. 16. (*A*) This patient, who died from a variety of conditions (see text), presented an enlarged heart, prominent pulmonary artery segment, a "moustache" sign, and evidence of chronic pulmonary emphysema. (*B*) Right anterior oblique view of same case. The pulmonary conus is greatly enlarged, producing a rectangular contour of the heart. The esophagus is not displaced.

He was not cyanotic and his disability was extremely minimal. Neither ventricle was enlarged.

10. *Multiple Co-existing Lesions.* Figure 16 illustrates a case which was truly an enigma to both the cardiologist and the radiologist. The clinicians believed the patient to have an aneurysm in the root of the aorta. Blood pressure determinations had been quite variable, at times being as high as 160/110. The Department of Radiology had followed the patient as an atrial septal defect. Autopsy findings included moderate arteriolar nephrosclerosis, chronic pulmonary emphysema, luetic aortitis, and diffuse sclerosis of the pulmonary arterioles. It could not be proved that this last diagnosis was luetic in origin, although it was strongly suspected. At any rate it was probably responsible for a great deal of the marked hypertrophy of the pulmonary conus as seen in Figure 16*B*. The diagnosis of chronic cor pulmonale is obviously not justified.

SUMMARY

1. The diagnosis of cor pulmonale is easily missed because (a) the patient is frequently very ill when admitted, and roentgenoscopic examination cannot be done satisfactorily; (b) roentgenograms in both oblique and posteroanterior projections are not taken; (c) extensive pulmonary disease may obscure the cardiac outline in all projections.

2. Before the diagnosis of cor pulmonale can be made, selective enlargement of the pulmonary conus and artery, with or without hypertrophy of the body of the right ventricle, must be shown. Pulmonary emphysema is almost always a demonstrable feature.

3. Careful correlation of the clinical, catheterization, and roentgen findings are necessary to exclude other causes of an enlarged pulmonary conus and artery. These conditions are:

(1) Congenital heart disease.
  (a) Interatrial septal defect.
  (b) Lutembacher's syndrome.
  (c) High interventricular septal defect.
  (d) Patent ductus arteriosus.
  (e) Eisenmenger's complex.
  (f) Pulmonic stenosis.
(2) Mitral stenosis.
(3) Thyroid heart disease.
(4) Cardiac failure.
(5) Aneurysm of the pulmonary artery.
(6) Kyphoscoliosis.
(7) Age and habitus.
(8) Ayerza's disease.
(9) Idiopathic dilatation of the pulmonary artery.

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Matthew O. Marks, M.D.
1761 Beall Ave.
Wooster, Ohio

REFERENCES

1. Abbott, Maude E. Atlas of Congenital Cardiac Disease. American Heart Association, New York, 1936.
2. Bedford, D. E., Papp, C., and Parkinson, J. Atrial septal defect. *Brit. Heart J.*, 1941, *3*, 37–68.
3. Clawson, B. J. In: A Textbook of Pathology. By E. T. Bell. Sixth edition. Lea & Febiger, Philadelphia, 1947, p. 622.
4. Clerc, A., and Mourrut, E. Bronchite chronique sans cyanose, lésions probables de l'artère pulmonaire, déclées par le seul examen radiothérapique. *Bull. et mém. Soc. méd. d. hôp. de Paris*, 1931, *47*, 292–299.
5. De Nardi, J. M., Van Ordstrand, H. S., and Carmody, M. G. Chronic pulmonary granulomatosis. *Am. J. Med.*, 1949, *7*, 345–355.
6. de Navasquez, S., Forbes, J. R., and Holling, H. E. Right ventricular hypertrophy of unknown origin: so-called pulmonary hypertension. *Brit. Heart J.*, 1940, *2*, 177–188.
7. East, T., and Bain, C. Recent Advances in Cardiology. The Blakiston Company, Philadelphia, 1948.
8. Gilchrist, A. R. Patent ductus arteriosus and its surgical treatment. (George Alexander Gibson lecture.) *Brit. Heart J.*, 1945, *7*, 1–36.
9. Herrmann, G. R., and Wilson, F. N. Ventricular hypertrophy. *Heart*, 1922, *9*, 91–147.
10. Herrmann, G. R. Experimental heart disease; methods of dividing hearts; with sectional and proportional weights and ratios for 200 normal dog hearts. *Am. Heart J.*, 1925, *1*, 213–231.

11. LEWIS, T. Observations upon ventricular hypertrophy with especial reference to preponderance of one or other chamber. *Heart*, 1914, *5*, 367–403.
12. LUND, H. Z. Personal communication.
13. PARKINSON, J., and HOYLE, C. Heart in emphysema. *Quart. J. Med.*, 1937, *6*, 59–86.
14. PILLMORE, G. U., Editor. Clinical Radiology: A Correlation of Clinical and Roentgenological Findings. In two volumes. F. A. Davis Company, Philadelphia, 1946, Vol. I, p. 13.
15. RIGLER, L. G., and HALLOCK, P. Chronic cor pulmonale. AM. J. ROENTGENOL. & RAD. THERAPY, 1943, *50*, 453–460.
16. ROBB, G. P., and STEINBERG, I. Visualization of chambers of heart and thoracic blood vessels in pulmonary heart disease. *Ann. Int. Med.*, 1939, *13*, 12–45.
17. ROESLER, H. Clinical Roentgenology of the Cardiovascular System. Second edition. Charles C Thomas, Springfield, Illinois, 1943.
18. SCOTT, R. W., and GARVIN, C. F. Cor pulmonale: observations in 50 autopsy cases. *Am. Heart J.*, 1941, *22*, 56–63.
19. SCHWEDEL, J. B. Clinical Roentgenology of the Heart. Annals of Roentgenology. Vol. XVIII. Paul B. Hoeber, Inc., New York, 1946.
20. TAUSSIG, HELEN B. Congenital Malformations of the Heart. Commonwealth Fund, New York, 1947.
21. ZIMMERMAN, H., RYAN, J., and SCOTT, R. W. *Dis. of Chest.* In press.

Vol. 66, No. 1

INTERPRETATION OF NORMAL CARDIOVASCULAR ANGIOGRAMS*

WITH A DISCUSSION OF COMMON ERRORS

By MARCY L. SUSSMAN, M.D.,† *and* SIGMUND A. BRAHMS, M.D.
Department of Radiology, The Mount Sinai Hospital
NEW YORK, NEW YORK

ANGIOCARDIOGRAPHY is a procedure in which roentgenograms are made of constantly changing structures, the heart and great vessels, following the very rapid intravenous injection of a large quantity of radiopaque solution. The cavities of the cardiac chambers and the lumens of the great vessels are visualized and, within certain limits which will be discussed later, a satisfactory estimate of the size of these structures can be obtained. Interesting physiological data also are obtainable when a suitable recording method is used. Under ordinary conditions, in the adult, the right ventricle and pulmonary arteries are visualized some two and one-half seconds or two to three heart beats after the end of injection, the left ventricle and aorta at about a six second interval or after ten to twelve heart beats.

Certain limitations are inherent in the angiocardiographic method. The final record is a composite of three elements: the injection, the anatomy and physiology peculiar to the examined individual, and the recording system. The injection, which in an adult consists of 40 to 50 cc. of material, is made as rapidly as possible through a large bore needle, the injection being completed preferably within one and one-half seconds. However, the speed of injection, or more particularly, the speed with which the bolus of material enters the heart is not always entirely under the control of the operator. Distensibility of the arm veins, the anatomical relations of the subclavian vein as it enters the thorax, the pressure in the right auricle during the injection, particularly as it is influenced by intrathoracic pressure, and, parenthetically, attention is called to the possibility of an unintentional Valsalva maneuver all contribute to distinct variation. Even in the hands of the expert, the injection is occasionally slow, interrupted or jerky. The effect of the anatomical relations of the subclavian vein are not generally appreciated. There may be sufficient obstruction, for example, so that even a semiflexible catheter cannot be passed into the heart. When this is present the diodrast collects in the veins around the shoulder and in the neck; only a small amount passes immediately into the heart. The rest enters after an interval and slowly. These effects are so striking in many instances that a statement that there is visualization of one or other part of the heart so many seconds after the beginning or end of injection should be examined critically. It is for this reason that we have made no effort to use the injection to start the roentgen exposures automatically, as was done for cerebral arteriography by Engeset and Kvadsheim.[2]

When diodrast enters the heart, and particularly the right cardiac chambers, it does not necessarily fill these chambers in such a way as to give complete anatomic delineation. There are several reasons for this. In the first place, a certain minimum concentration of diodrast is needed before it is visualized, and therefore any portion of the heart not containing this requisite concentration will not be seen. That there is not complete mixing of blood in the right auricle has been adequately demonstrated by withdrawing samples of blood from various parts of this chamber and subjecting them to oxygen analysis. There is a wide

* Presented at the Forty-ninth Annual Meeting, American Roentgen Ray Society, Chicago, Ill., Sept. 14–17, 1948.
† Now at 801 North Second Ave., Phoenix, Arizona.

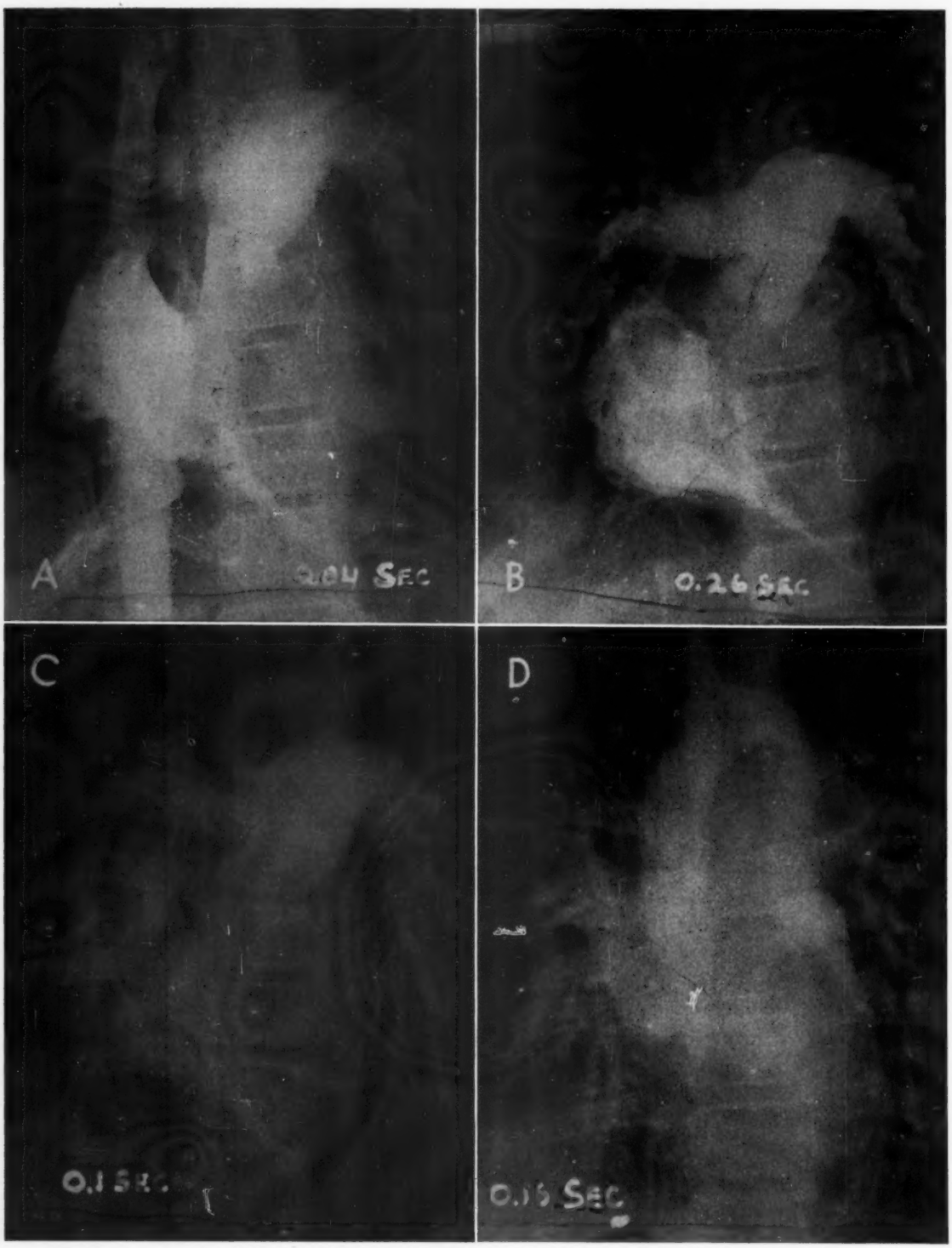


FIG. 1. (*A*) Illustrates the appearance of the outflow tract of the right ventricle in systole. Also shown is the superimposition of the right auricle on the right ventricle in the posteroanterior projection. (*B*) In diastole the pulmonary valves and sinuses may be seen. The outflow tract is frequently not visualized at this time. The pulmonary artery and its branches are well seen. (*C*) Only a faint visualization of the cardiac chambers occurs in the interval between the emptying of the right side and the appearance of diodrast-containing blood in the left side of the heart. (*D*) The pulmonary veins, left auricle, and aorta are well seen but the left ventricle in systole is often not well demonstrated.

variation between the samples taken near the superior vena cava as contrasted with those taken near the inferior vena cava. Even blood from various portions of the right ventricle may show significant differences in oxygen content but this is uncommon. It is generally assumed that only the pulmonary artery blood is surely homogeneous. Furthermore, there appear to be anatomic reasons for uneven distribution of diodrast in the right auricle and ventricle.

To study these questions and to minimize possible errors, it is our routine procedure to make at least twelve roentgen exposures. These are spaced to cover the likely time that diodrast will be found in the heart and aorta. In the usual individual this is about eight seconds so that the exposures are 0.66 second apart. However, when the heart rate is rapid or when there is evidence of an intracardiac shunt, the exposures can be made more quickly, as fast as 0.5 second apart. An electrocardiogram is recorded simultaneously and on this tracing the times at which the roentgen exposures occur are registered. In this way, it is possible to determine in which phase of the cardiac cycle the exposures were made. It is also possible with the present apparatus to make the exposures at predetermined phases of the cardiac cycle. The R wave in the electrical current from the heart is used to energize the roentgen exposure mechanism. Delay circuits are used so that each exposure is made at a predetermined time.[3] The roentgen exposures themselves do not exceed 1/40 second. Studies of the sequence made in this way (Fig. 1), and confirmed by study of motion pictures of the roentgenoscopic screen, show the potentiality for error when only a limited number of roentgenograms are available. For example, at the beginning of systole, the outflow tract of the right ventricle is distended; 0.2 second later it is contracted, producing an unusual hiatus between the base of the pulmonary artery and the visible right ventricle. This could easily be mistaken for subpulmonic stenosis. The appearance of the pulmonic valve itself changes during the various phases of the cardiac cycle. The right auricle also changes considerably. Often, when diodrast first enters this chamber, the lower half of the auricle is not filled and presents a crescentic defect. A large triangular extension to the left may be seen which could be mistaken for part of the right ventricle or for passage of the diodrast through an interatrial septal defect. Diodrast normally tends to remain in the auricular appendage after the rest of the auricle is emptied.

The right ventricular cavity is not often seen completely free of an overshadowing right auricle. Its right border is particularly difficult to define. The pulmonary artery is ordinarily visualized without difficulty. However, its measurement is not always easy probably because the portion between the pulmonary sinuses and the bifurcation is short and not sharply defined in all positions of the patient. The pulmonary veins and the left auricle are usually well seen if several roentgen exposures are available. The best visualization is obtained in early ventricular systole. The left ventricle, however, is not well defined, particularly the outflow tract. This portion of the left ventricle is so poorly outlined that attempted demonstration of subaortic stenosis is usually unsuccessful. However, only in the left ventricle is it possible ordinarily to measure the thickness of the muscle since it is only in this chamber that there is the combination of complete mixing of the diodrast in the cavity with satisfactory contour of the wall. In order to make this measurement, however, it is obviously necessary that exposures be made in a predetermined phase of the cardiac cycle.

The aorta is visualized well, provided a satisfactory injection has been achieved. There is rarely any difficulty in establishing the nature of a lesion in the aorta. However, the decisive delineation of localized dilatation of the proximal descending aorta due to patent ductus arteriosus is complicated by the fact that the clear area created by the trachea and left main bronchus nor-

mally outlines a density adjacent to the aorta at just about the same level as the ductus were it to be present. This differential diagnosis requires, not infrequently, the critical scrutiny of many sequential films.

Physiologic interpretations must be made with great caution. The fact that a certain minimum concentration of diodrast is necessary to visualize any given area has already been pointed out. It must also be remembered that the rapid injection of 40 to 50 cc. of a concentrated solution produces an abnormal situation and perhaps some increase in pressure in the right auricle. The effect of this injection on cardiovascular dynamics is now being studied.* Preliminary observations indicate that there is little or no effect on the heart itself. Electrocardiograms made during the injection show a variable change in heart rate. Sometimes it is significantly increased; sometimes it is slowed; or there may be no change at all. On rare occasions, there have been alterations in rhythm. For example, on one occasion a transient heart block was found. Recordings made shortly after the injection often show some drop in blood pressure. On rare occasions, as is well known, the blood pressure may drop markedly to the extent of being a manifestation of shock. We cannot say, therefore, that the angiocardiogram provides a necessarily true picture of undisturbed cardiac physiology. Quite frequently in congenital cardiacs and not infrequently in normal individuals, reflux into the inferior vena cava and hepatic veins has been seen. This suggests that, at least in some individuals, the vena cavas and the right auricle form a single physiological unit with excess pressure being taken up in the available inferior vena cava. This finding is of some significance in the interpretation of the angiocardiogram and should always be sought when unusually long visualization of the right heart is seen. Certainly, the diagnosis of a left-to-right intracardiac shunt should be made with great hesitation when reflux into the inferior vena cava is noted.

Fig. 2. *A1* shows the right paracardiac density. *BA2* shows the column of diodrast splitting in the right auricle to outline a filling defect. *BA3*. Simultaneously with the opacification of the aorta the right auricular filling defect opacifies. *BA4* again shows, in the left anterior oblique projection, the right auricular filling defect. *BA5* demonstrates opacification in the left anterior oblique projection of the same defect.

This series illustrates the importance of an adequate number of films exposed during the passage of the diodrast through the heart and great vessels.

It is often desirable that two views of the angiocardiogram should be available. Ideally, one injection with two simultaneous series of roentgen exposures, as they are now made in Sweden,[1] meets this problem. However, there should be no hesitation in making two injections when necessary. This principle was illustrated by a case in which the diagnosis of an aneurysm of the right sinus of Valsalva was established (Fig. 2). Two injections with an adequate number of exposures in each were necessary to show the filling defect in the right auricle and then the defect filled with diodrast simultaneously with the base of the aorta. Certainly when a part of the cardiac contour or superior mediastinal shadow is unaccounted for, a second superior vena cava should be sought by injection of the opposite arm (Fig. 3).

* This study failed to reveal any significant increase in right auricular pressure following rapid intravenous injection.

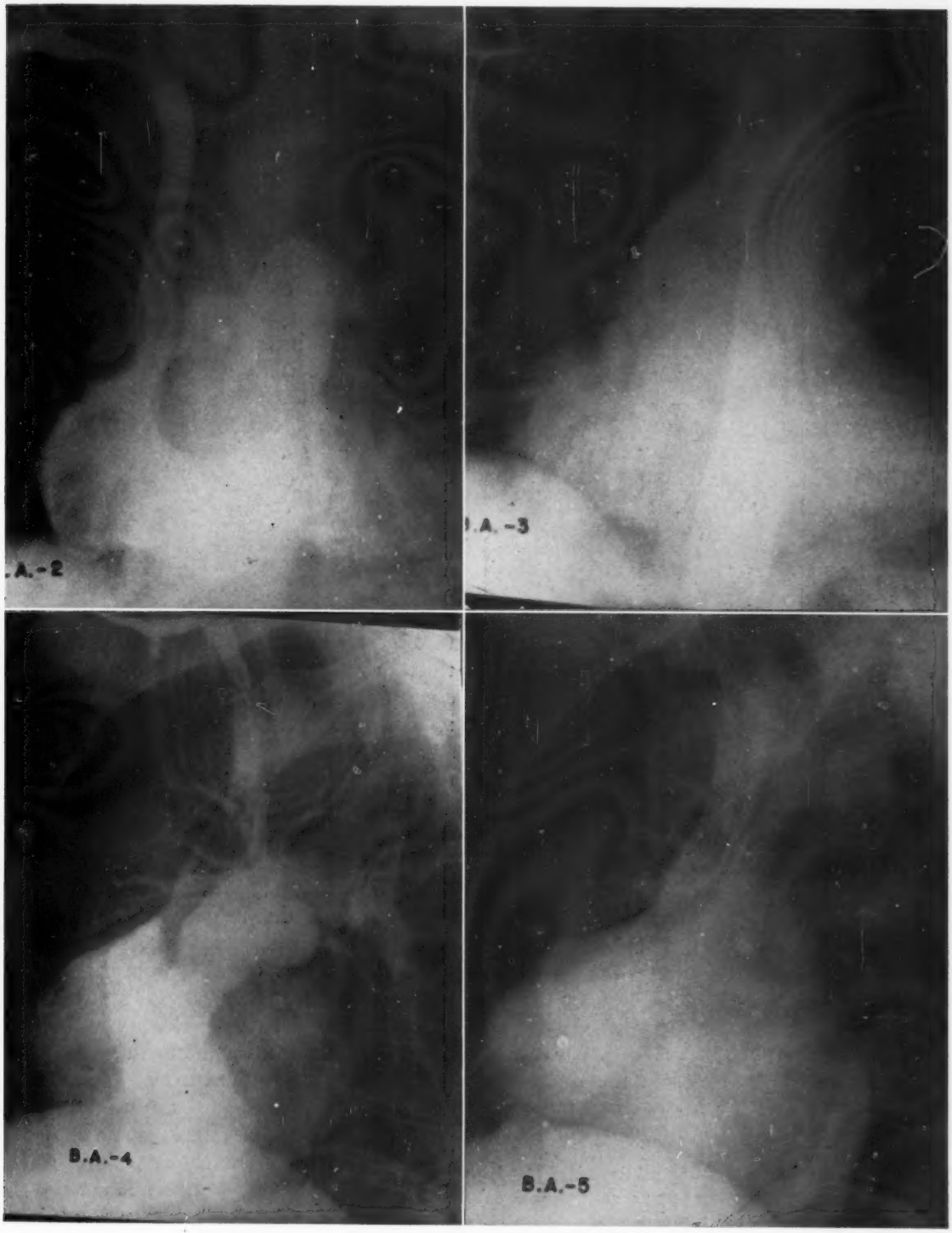


Fig. 2. *See legend opposite page.*

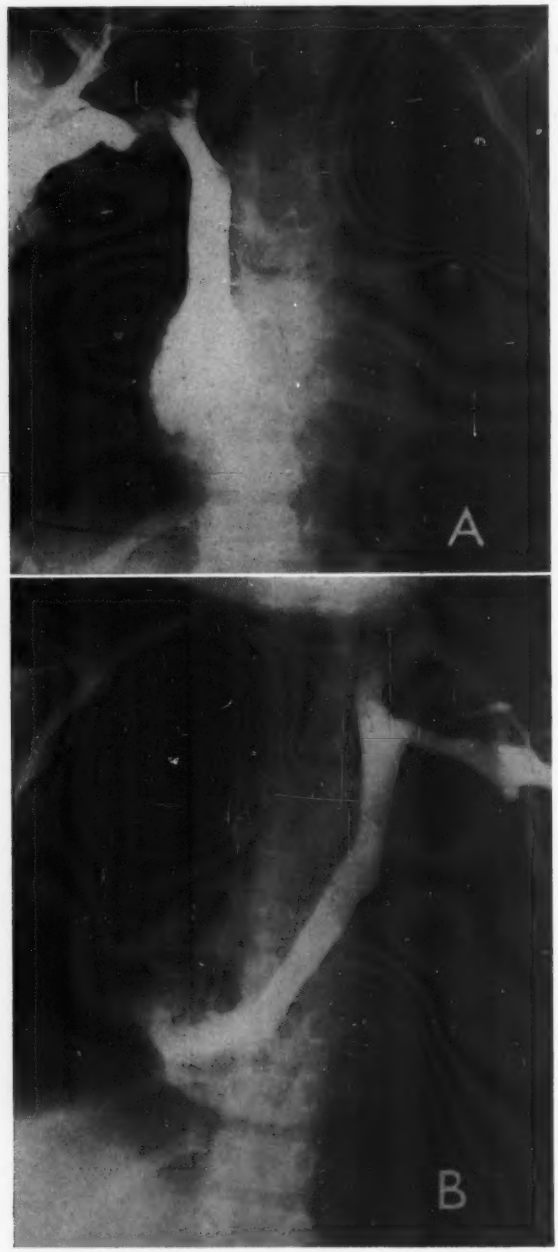


Fig. 3. (*A*) Diodrast is seen in the superior vena cava and in the right auricle; the latter incidentally is incompletely filled. A left superior paramediastinal density was unexplained by the first angiocardiogram. Accordingly a second injection was made by way of the left upper extremity. (*B*) Illustrates the presence of a left superior vena cava which empties into the right atrium, thereby establishing the presence of a double superior vena cava.

Interpretation in angiocardiography is greatly handicapped by the fact that, even with modern roentgen generators, successive exposures are not precisely of the same density. As a result, small intracardiac shunts giving rise to a slight change in density are established with difficulty. It is necessary, for example, that there be a fairly large shunt through a patent ductus arteriosus before one can be satisfied that the density of the pulmonary artery remains greater than would be expected after it should have emptied. A brief discussion of aortic aneurysm will serve further to clarify this point. Ordinarily an aneurysm fills when the vessel of its origin becomes dense. It is unusual that there is difficulty in diagnosis. However, occasionally, not enough diodrast enters the aneurysm to make the diagnosis unequivocal, particularly when there are density changes in the roentgenograms due to technical causes. Sometimes the small amount of diodrast entering an aneurysm is due to the presence of a small neck. Sometimes, it is due to the fact that the aneurysm has a very thick wall. A dissecting aneurysm, for example, rarely fills with diodrast because its communication with the aorta is too small. On one occasion, however, we were able to demonstrate that a considerable amount of diodrast did pass into the area of dissection. Fortunately, when the aneurysm is due to luetic aortitis but does not fill with diodrast, the diagnosis can be made by the demonstration of irregular dilatation of other portions of the aorta (Fig. 4). In this connection a warning is in order regarding the diagnosis of luetic aortitis from the demonstration of dilatation alone. Dilatation of the aorta occurs quite often in hypertension, beyond an area of coarctation, and not infrequently beyond congenital aortic valvular stenosis. We have also seen irregular dilatation in instances that we have called atypical coarctation. This is apparently a congenital anomaly in which the aorta is irregularly dilated between slightly constricted segments but the change is not sufficient to

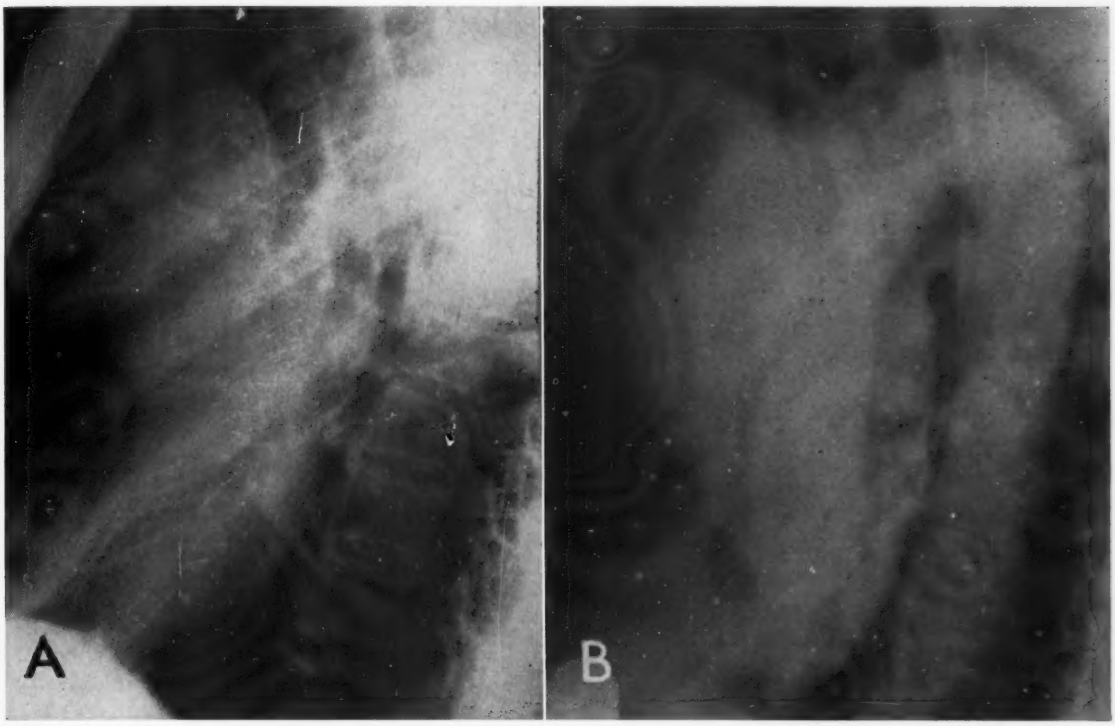


Fig. 4. (*A*) Shows a huge anterior superior mediastinal mass which clinically represented an aortic aneurysm. (*B*) Despite adequate visualization of the aorta and great vessels the aneurysm was not opacified, suggesting the likelihood that thrombosis had occurred within it.

produce other circulatory changes. The only hint of the condition may come from an associated stenosis of a major vessel, particularly of the left subclavian artery.

Angiocardiographic interpretation is subject to the usual potential errors when a diagnosis is made without confirming data or is contrary to the other available evidence. For example, we have repeatedly emphasized that the demonstration of a localized dilatation of the anterior surface of the proximal descending aorta only indicates a ductus arteriosus if there are supporting clinical data. We have observed a similar deformity in a case of Hodgkin's disease of the mediastinum which produced a small traction aneurysm. It is also important to recognize that this deformity of the aorta does not necessarily indicate patency of the ductus arteriosus. We have established on several occasions that a diverticulum-like protrusion on the aorta was the result of traction by a ligamentum arteriosum. Indeed it can be stated in general that catheterization of the pulmonary artery or, in our experience, microplethysmography of the fingers is more satisfactory in diagnosing patency than the angiocardiogram. To illustrate this further, the following case is cited:

L.B., a male, aged twenty-four, had been studied and treated at another institution for subacute bacterial endocarditis. At that institution, the examination which included angiocardiography suggested the diagnosis of patent ductus arteriosus. When we saw this patient, he had been cured of the subacute bacterial endocarditis. He presented a systolic thrill and loud, harsh systolic murmur at the third and fourth intercostal spaces to the left of the sternum with diminishing intensity at the pulmonic and aortic areas. This murmur was considered distinctly unlike that of patent ductus arteriosus. Therefore, the results of the angiocardiogram made elsewhere were not accepted. The patient was studied by all available means, including cardiac catheterization and microplethysmography of the fingers. The latter gave no evidence of an extracardiac

arteriovenous shunt. The former demonstrated a slight increase in the oxygen content of the right ventricular blood in its outflow tract, as compared with the samples taken from the apex and from the right auricle. It was considered, therefore, that the diagnosis of isolated interventricular septal defect was more likely than that of patent ductus arteriosus.

We have not infrequently been saved from serious error in the interpretation of an angiocardiogram because the history, clinical examination and thorough laboratory studies, including cardiac catheterization, supplied data which did not support the first angiocardiographic diagnosis. In general, it can be said that left-to-right intracardiac shunts are better established by intracardiac catheterization than by angiocardiography. For example, in interatrial septal defect with pulmonic stenosis, there is illustrated the value of an integrated examination as compared with the use of angiocardiography alone. It is very difficult to establish by angiocardiography whether diodrast is shunted from the right auricle to the left auricle and thence to the left ventricle and aorta, or whether the diodrast has passed from right auricle and right ventricle through an overriding aorta. In the usual instance of interatrial septal defect with pulmonic stenosis, the pulmonary artery is not very small as is usually seen in tetralogy of Fallot. However, in this connection it is worthy of note that the angiocardiogram does not always give a correct impression of the size of the pulmonary artery. One should hesitate greatly to state that the pulmonary artery is atretic because it is not seen by angiocardiography. However, when it is visualized clearly and its outlines can be definitely established, the angiocardiogram provides an accurate index of its size. This type of case also illustrates the possibility of visualizing accurately subpulmonic stenosis, provided the roentgenograms are controlled either through a synchronizer or at least by knowing at which phase of the cardiac cycle the roentgenograms have been made (Fig. 1).

It is impossible to illustrate here all of the possible errors that may occur. Angiocardiography is subject to the same human error which is common to all other phases of medical work. One important source of difficulty, for example, is the assumption that because a structure is not seen it is not present. Another is the result of reading too much into the roentgenogram. For example we had an instance in which the descending branch of the right pulmonary artery was not visualized. There was an apparent atelectasis of the right lower lobe. Because we have found occlusion of a main branch pulmonary artery most often in bronchial carcinoma, we assumed that this was the diagnosis. At autopsy, however, it was found that there had been a pulmonary embolus.

CONCLUSION

Certain technical difficulties in the production of angiocardiograms are outlined. Illustrations are given to demonstrate that errors in interpretation are minimized when the examination is performed by an experienced coordinated team, when the other clinical data are accurate and complete and have been gathered and evaluated by those with the necessary experience in the field, and when all of the available physiologic tests are employed so that the final result represents an integrated examination of the patient.

Sigmund A. Brahms, M.D.
The Mount Sinai Hospital
New York 29, N. Y.

REFERENCES

1. CRAFOORD, C. Personal communication.
2. ENGESET, A., and KVADSHEIM, H. Technical improvements in cerebral angiography. *Acta radiol.*, 1948, *29*, 83–86.
3. SUSSMAN, M. L. In: Medical Physics. O. Glasser, Editor. Year Book Publishers, Inc., Chicago, 1950, Vol. II.

Vol. 66, No. 1

A NEW ROENTGEN SIGN OF BRONCHO-EXTRA PLEURAL PERFORATION IN LUCITE PLOMBAGE*

By ALLAN HURST, M.D., *and* MORRIS A. LEVINE, M.D.
DENVER, COLORADO

EXTRAPLEURAL pneumonolysis with plombage of one substance or another has been done for many years. The most recently heralded plombe is lucite (methylmethacrylate) a hard, non-toxic substance used in the form of hollow spheres 1 inch in diameter. First used by Wilson and Baker,[2] the group at the National Jewish Hospital have been among its greatest protagonists in the past two years. Over 70 cases have been completed at this hospital and a report of the results are to be published presently.

One of the most serious complications to be encountered following this operation is that of tuberculous extrapleural empyema, due to slow perforation of a caseous area at the pulmonary periphery directly under the extraplural shelf. Whether the rigid plombe substance—the lucite spheres—actually causes the perforation by erosion is not the nucleus of this presentation. Suffice it to say, the same complication has been observed even in cases of extrapleural pneumothorax where no plombe is present. One plausible theory is that the tuberculous process (cavity) secures some of its blood supply from the parietal pleura and endothoracic fascia through the formation of adhesions in these areas. The separation of these layers by cleavage at operation in order to provide an extrapleural space is thought to destroy the integrity of this blood supply, leading to progressive necrosis at the pleural shelf.

An early diagnosis of this complication is frequently most difficult clinically, because few symptoms occur during such a slow perforation. The reappearance of positive sputum after its previous conversion, spread of disease to the homolateral or contralateral side, or an extraordinary increase in cough or expectoration, may not appear until weeks or months after perforation. If the diagnosis could be made before such symptoms actually appeared, the plombe could be removed and thoracoplasty done before further damage by spread occurred.

Among the 70 cases of extrapleural pneumonolysis with lucite plombage, we have thus far had 2 cases develop such perforation while under our observation. Two additional cases, begun elsewhere, were admitted to the National Jewish Hospital and treated for this complication late in the course of their treatment. In the most recent of our cases we were able to make the diagnosis early by a new roentgen finding. After reviewing the other cases, the same sign was identified. It may be noted parenthetically that perforation was present months before treatment was actually initiated.

Case 1. O. E., white male, aged thirty-eight, was admitted on March 29, 1947. Onset November, 1946, with malaise, fatigue, and vomiting. By January, 1947, he had lost 20 pounds. Chest roentgenogram showed pulmonary tuberculosis, positive sputum was found, and he was admitted to a sanatorium where he was placed on bed rest. On admission to this hospital, the sputum was highly positive and E.S.R. was 74 mm.

Roentgen examination showed extensive fibro-exudative changes in both upper lobes, especially on the left, where there was a giant cavity in the upper lobe, including the apex, first and second interspaces. He was placed on bed rest and the cavity rapidly decreased in size. On October 21, 1947, there were several large hemoptyses with a post-hemoptoic spread to both bases. Treatment with streptomycin was begun and the spread rapidly cleared. Left pneumothorax was attempted but failed. Because of residual cavity in the left upper lobe and positive sputum, an extrapleural pneumonolysis with lucite plombage was done in May,

* From The National Jewish Hospital in Denver and The University of Colorado Medical Center, Denver, Colorado.

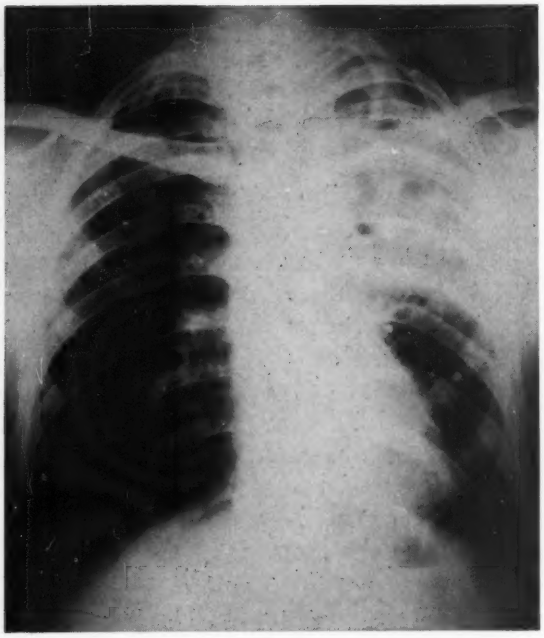


Fig. 1. Case 1. June 10, 1948. The lucite spheres are visible through a serofibrinous exudate.

1948. Recovery was uneventful, sputum was converted and the patient rapidly improved. Early in September, he complained of some pain in his left chest. Physical examination and

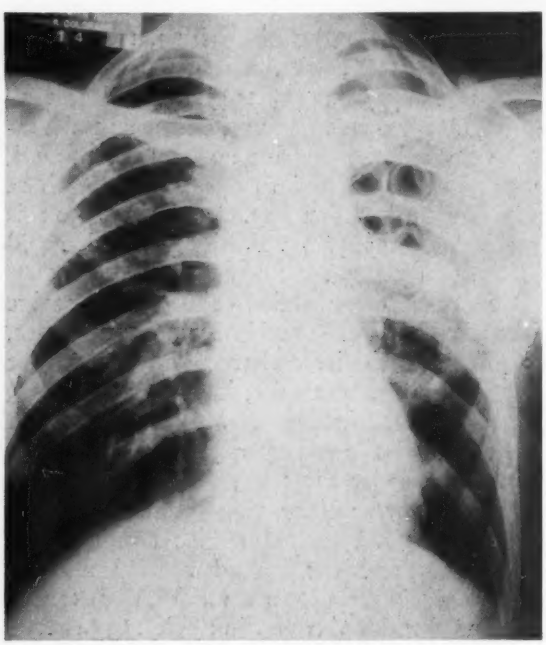


Fig. 2. Case 1. September 14, 1948. The lucite spheres are visualized with striking clarity in a medium of air except at the pleural shelf.

another roentgenogram failed to show the source of any new difficulty. Since he desired to leave, he was permitted to go home in September, 1948, and he returned to work. In December, his sputum was again positive, there was a loss of 8 pounds, cough increased. He was re-admitted December 29, 1948, and sputum was highly positive. Methylene blue injected into the extrapleural space was quickly expectorated. On January 18, 1949, through a posterolateral incision, twenty-two lucite spheres were removed, as well as the first five ribs. Patient withstood the operation very well. On January 23, 1949, it was noted that there

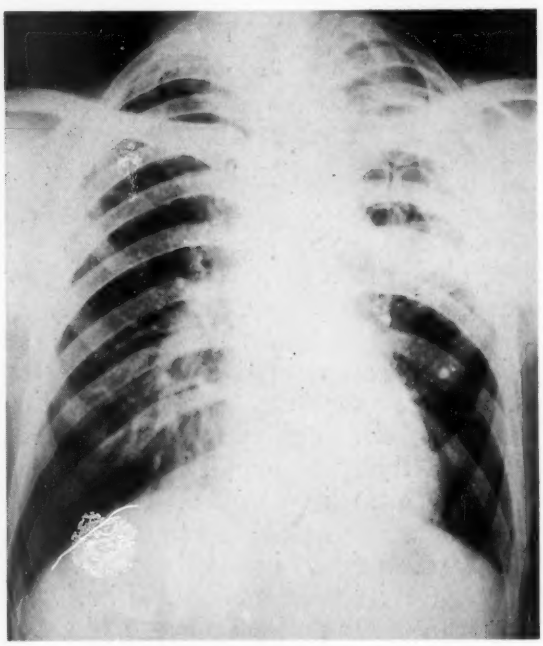


Fig. 3. Case 1. December 27, 1948. Similar to Figure 2.

was mild paradoxical breathing and at 9:00 P.M. that night, he died. Postmortem examination showed evidence of a large embolus in the left pulmonary artery with marked pulmonary edema particularly involving both lower lobes. There was an ulcerated area through the pleural shelf, penetrating into the lung, seen at both operation and postmortem.

Case II. E. B., white female, aged forty-four, was admitted on December 1, 1948. Onset in April, 1945, when chest roentgenogram showed a lesion in the right upper lobe. In spite of bed rest with intermittent sanatorium care, sputum

remained persistently positive. In June, 1948, a right extrapleural pneumonolysis with lucite plombage was performed. She left the hospital and apparently remained well until August, 1948, when "pneumonia" developed on the right. The sputum remained positive and the patient ran a febrile course, becoming worse up to the time of admission. Roentgenogram on entrance showed a fresh exudative process with an effusion at the left base. She was treated with streptomycin and penicillin and there was a rapid fall of temperature to normal. Because of the new contralateral disease, perforation was suspected and methylene blue was instilled

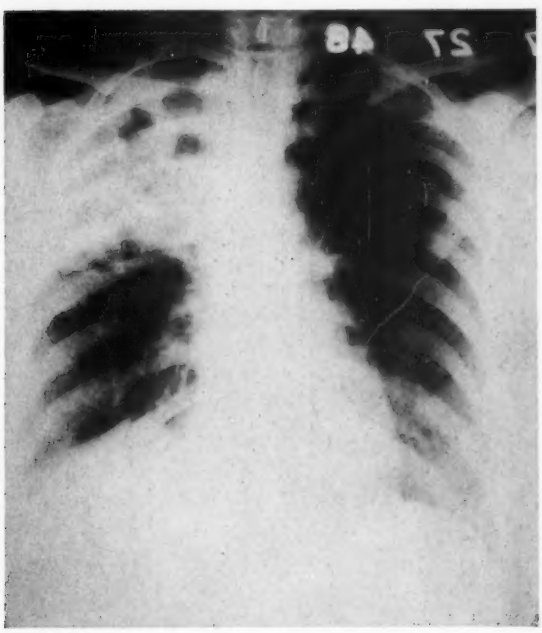


Fig. 4. Case II. July 27, 1948. The lucite spheres are visualized as translucent bodies in a water-dense medium.

into the extrapleural space and quickly expectorated. Roentgenogram in two weeks and one month after admission showed considerable clearing on the left. On January 4, 1949, a seven rib thoracoplasty was done, with removal of thirty lucite spheres. A large fistula was found at the base of the extrapleural space through which bubbles of air issued freely. The post-operative course has been quite satisfactory.

Case III. M. D., Negro male, aged thirty-seven, was admitted on September 7, 1948. Onset in August, 1947, when a diagnosis of tuberculous pneumonia was made at another

Fig. 5. Case II. August 11, 1948. The lucite spheres are sharply visualized in the absence of water-dense substance except at the pleural shelf. At the apex, there is a zone devoid of lucite spheres, the extrapleural space having become enlarged.

hospital. Left pneumothorax was attempted without success. On January 17, 1947, a left

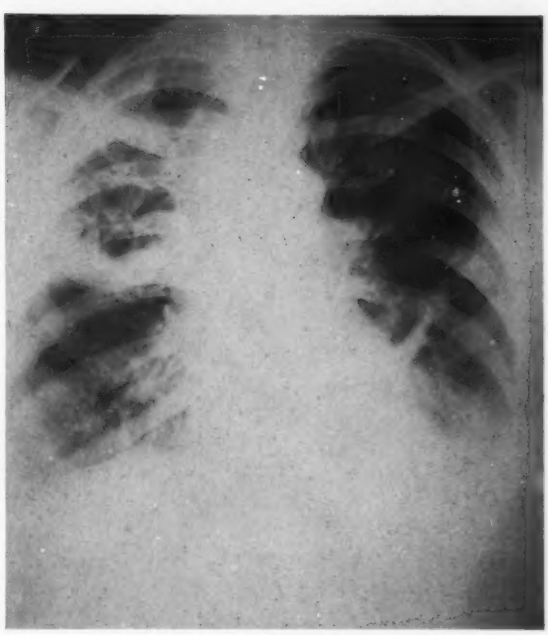


Fig. 6. Case II. December 1, 1948. Similar to Figure 5 with contraction of the extrapleural space and with contralateral spread.

Fig. 7. Case II. February 28, 1949. Following removal of spheres and thoracoplasty.

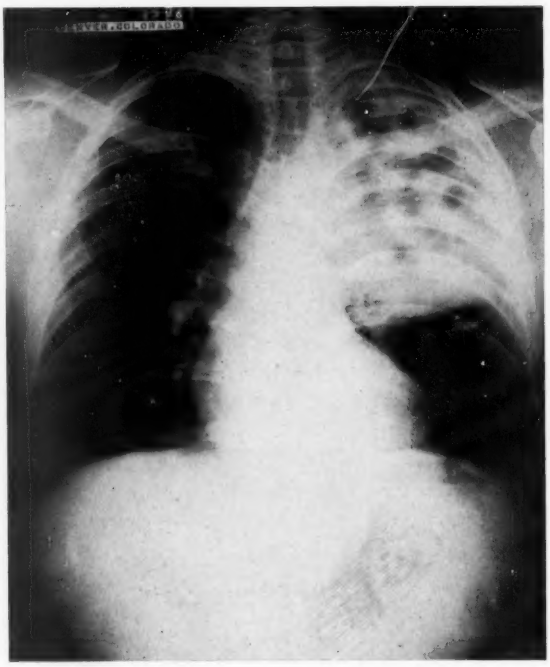


Fig. 8. Case III. June 21, 1948. The lucite spheres are visible through a serofibrinous exudate.

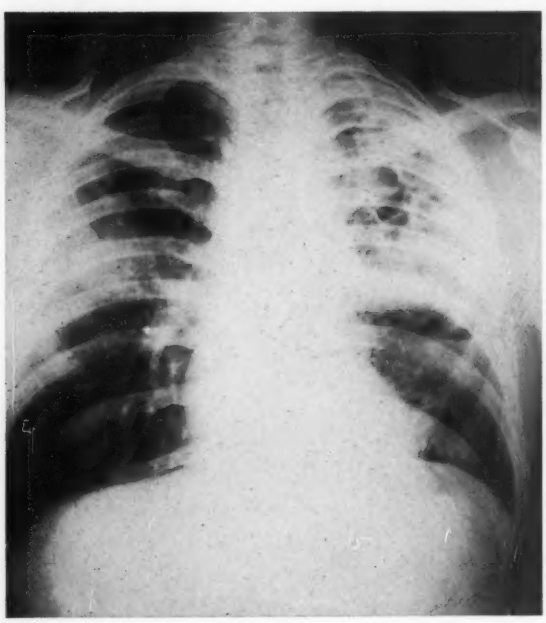


Fig. 9. Case III. September 8, 1948. The lucite spheres are visualized with striking clarity in a medium of air except at the pleural shelf.

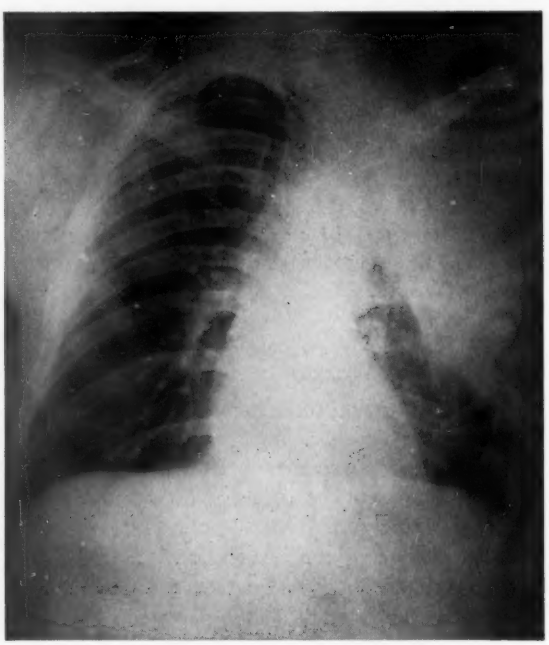


Fig. 10. Case III. December 19, 1948. Following removal of lucite and performance of thoracoplasty.

extrapleural pneumonolysis with lucite plombage was done. Fluid was subsequently aspirated on several occasions from the left chest. He left the hospital in April, 1948. Sputum remained negative. In June, 1948, he began to notice swelling of left upper chest around incision. Every week thereafter, for six weeks, fluid was aspirated and cavity was lavaged with streptomycin. Roentgen examination on admission showed an extrapleural pneumonolysis on the left with lucite. The normal opacity

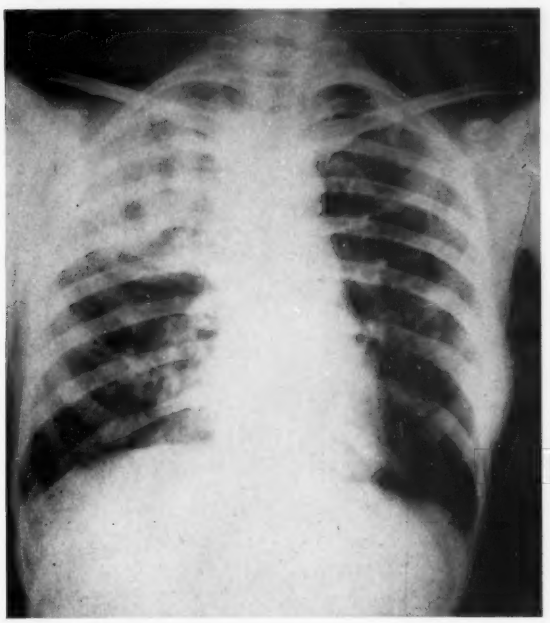


Fig. 11. Case iv. December 1, 1948. The lucite spheres are visble through a serofibrinous exudate.

between the lucite spheres had been replaced with air. There was a fresh exudative spread to the right upper lobe. The sputum was highly positive for tubercle bacilli. E.S.R. was 77.

On September 13, 1948, six days after admission, the extrapleural space was opened, the lucite spheres removed, and the first seven ribs resected. The intercostal bundles were allowed to fall into the space. The muscles were approximated and a drain was left in place. Streptomycin was continued postoperatively. A few days later, the tube was removed and the sinus continued to drain intermittently. A roentgenogram taken on October 18, 1948, showed obliteration of the empyema space and considerable clearing of the spread in the contralateral lung. The patient elected to continue bed rest at home. Follow-up roentgenogram on December 19, 1948, showed considerable clearing of the contralateral lesion as well as excellent collapse of the extrapleural space.

Case iv. J. C., white female, aged twenty-four, was admitted on April 16, 1948. Productive cough one year with fatigue. One month prior to admission, she developed low grade fever, night sweats, and weight loss of 10 pounds. Roentgen examination on April 17, 1948, revealed very extensive fibro-exudative

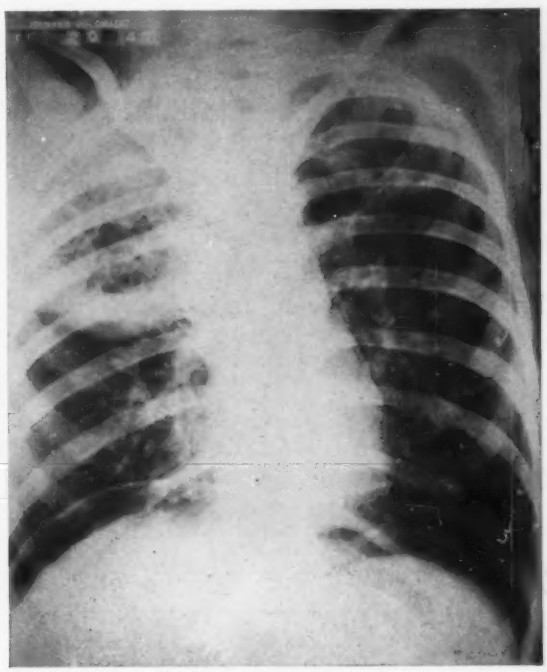


Fig. 12. Case iv. January 20, 1949. The lucite spheres are visualized in an air medium. Pneumoperitoneum is also present.

changes throughout both upper lobes combined with large cavities in both supraclavicular and infraclavicular regions. Sputum was highly positive. E.S.R. was 56.

The patient was placed on bed rest and over the next few months received two six-week courses of streptomycin (1 gram daily), with initial improvement, but with later recurrence of symptoms and slow deterioration. As a desperate measure, because of her slow steady retrogressive course, an extrapleural pneumonolysis, with instillation of lucite spheres, was done on October 5, 1948. Two days later, temperature rose to 101° F., and serosanguineous fluid was aspirated through the tube draining the extrapleural space. Later films showed a spread to right middle lobe. Pneumo-

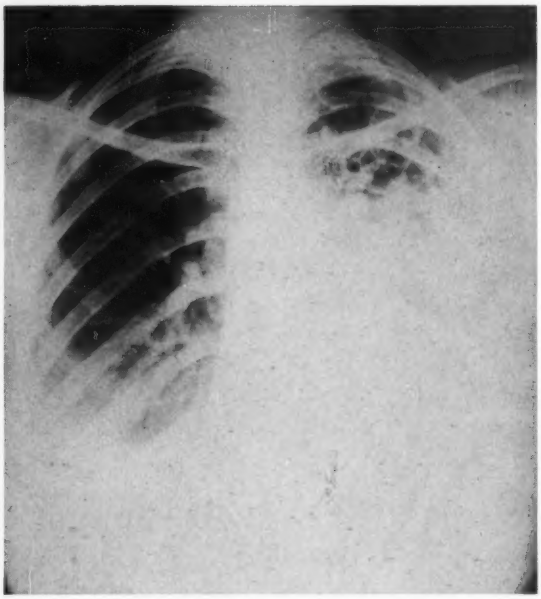


FIG. 13. Case v. December 2, 1948. The lucite spheres are visualized in the upper portion of the extrapleural space in an air medium postoperatively.

peritoneum was initiated in January, 1949. On a posteroanterior roentgenogram taken at that time, a remarkable abrupt change was noted in the extrapleural area. The opacity regularly seen around the spheres was now replaced by a clear space representing air.

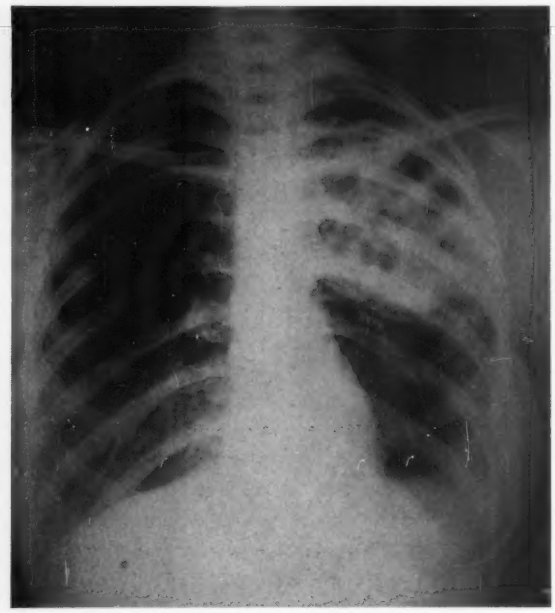


FIG. 14. Case v. January 13, 1949. There is less air present in the extrapleural space.

Since a perforation was suspected, 5 cc. of methylene blue was injected into the extrapleural space, which was promptly expectorated.

CASE v. D. A., white female, aged twenty-eight, was admitted on December 26, 1947. She had been ill with bilateral pulmonary tuberculosis since 1935. On admission, there was an effective pneumothorax on the right and multiple cavitations in the left upper lung field. The right pneumothorax was discontinued, and on November 30, 1948, an extra-

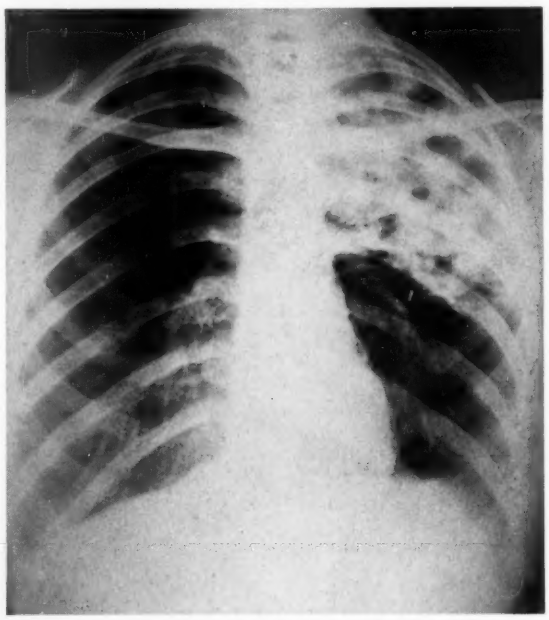


FIG. 15. Case v. March 3, 1949. The air around the spheres has now been replaced by a serofibrinous exudate.

pleural pneumonolysis was done on the left, with insertion of forty-seven lucite spheres. Chest roentgenogram on December 2, 1948, showed the lucite spheres in the upper portion of the extrapleural space to be highlighted by the air surrounding them. This is similarly seen in the film of January 13, 1949, but to a lesser degree. In the last film dated March 3, 1949, the air has been replaced by a serofibrinous covering.

DISCUSSION

Following the formation of the extrapleural space and the insertion of lucite spheres, a small amount of bleeding occurs

into the space. In addition, an effusion appears within a few days which, while rarely extensive, is sufficient to cause a low grade febrile reaction for a week or ten days. As the effusion is resorbed, a small serofibrinous exudate fills the interstices between the spheres. This produces a characteristic pattern of density between the spheres on the roentgenogram. Even where little reaction occurs, it is of the utmost importance to recognize that there is invariably some opacity in the spaces between the spheres.

When perforation occurs through the extrapleural shelf, with production of a communication between the lung parenchyma and extrapleural space, the roentgenogram undergoes a striking change, which is probably pathognomonic. Air finds its way in the interstices between the spheres, and the spheres then appear sharply outlined by contrast with the surrounding air. If a moderate amount of serum is still present between the spheres prior to perforation, a fluid level may develop simultaneously.

Occasionally, immediately after the insertion of the lucite spheres, air is visible in the extrapleural space between the spheres. This air may remain for a period of weeks but there is a progressive diminution in the amount of air and concomitant increase in the amount of serum present in follow-up films. This is in contrast to the pathological situation which develops in the course of perforation of the pleural shelf. Case v is an illustration of the sequence occasionally seen postoperatively, in which air is normally found in the extrapleural space surrounding the lucite spheres.

The importance of the early recognition of this sign of spheres sharply outlined by air on the roentgenogram is obvious after the spheres have once been shown roentgenographically to be bathed in a water-dense medium in an upright film. It may be observed that in 3 of the 4 cases presented this was the only evidence of perforation. The significance of this was not immediately clear in the early cases. Its early recognition and evaluation is of the utmost importance in order that procedures demanded for its treatment be immediately instituted.

3800 East Colfax Ave.
Denver 6, Colorado

REFERENCES

1. Grow, B., Hurst, A., and Perlmutter, H. An evaluation of extrapleural pneumonolysis with lucite plombage. *Trans. Nat. Tuberc. Assoc.*, 1949.
2. Wilson, D. A., and Baker, H. Experimental surgical pulmonary collapse. *Surg., Gynec. & Obst.*, 1946, *82*, 735–742.

THE ROENTGENOGRAPHIC DEMONSTRATION OF GLASS FRAGMENTS IN THE EYE

By WENDELL E. ROBERTS, Sc.D. (HON.)
Department of Roentgenology, Charlotte Eye, Ear and Throat Hospital
CHARLOTTE, NORTH CAROLINA

THE roentgenographic demonstration of glass as a foreign body in the eye (globe) is and always has been one of the most difficult problems confronting the roentgen department. All too frequently this problem has been passed by as hopeless. The literature contains numerous conflicting statements as to the radiopacity of glass.[1,2,3,4,5]

This paper is not concerned with the demonstration of glass foreign bodies of the anterior chamber of the eye which are readily demonstrated on a bone free roentgenogram. This study is concerned with those glass fragments which penetrate beyond the anterior chamber or lodge in the orbital tissue outside the globe. These glass foreign bodies which penetrate beyond the anterior chamber, or are in the trbital tissue, must of necessity be demonsorated, if possible, on a conventional no-screen film, the same as metallic foreign bodies. This is imperative for localization which in turn must guide the ophthalmologist in handling the case to the best advantage. This study was initiated in an attempt to determine how many and what kinds of glass could be demonstrated on a roentgenogram. Not all glass is sufficiently radiopaque to cast a shadow. However, many more kinds are radiopaque than are universally thought to be. Some enlightening information, and in several instances some surprising facts, was uncovered during this study on glass foreign bodies, particularly the radiopacity of lenses 29-33-35 in Figure 2, *A* and *B;* Chart 1, A and B.

My interest in the demonstration of glass in the eye was particularly stimulated by Case 1 (Fig. 1, *A* and *B*, a conventional no-screen film made for localization).

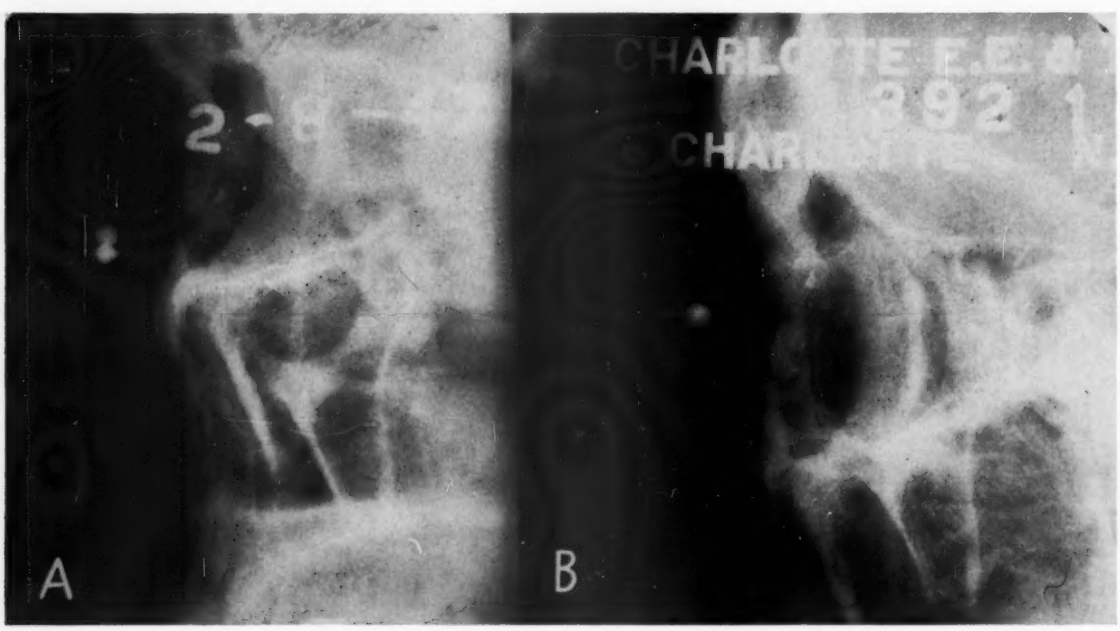


FIG. 1. Case 1. Conventional no-screen film. Eye glass lens fragment demonstrated and localized within the eye.

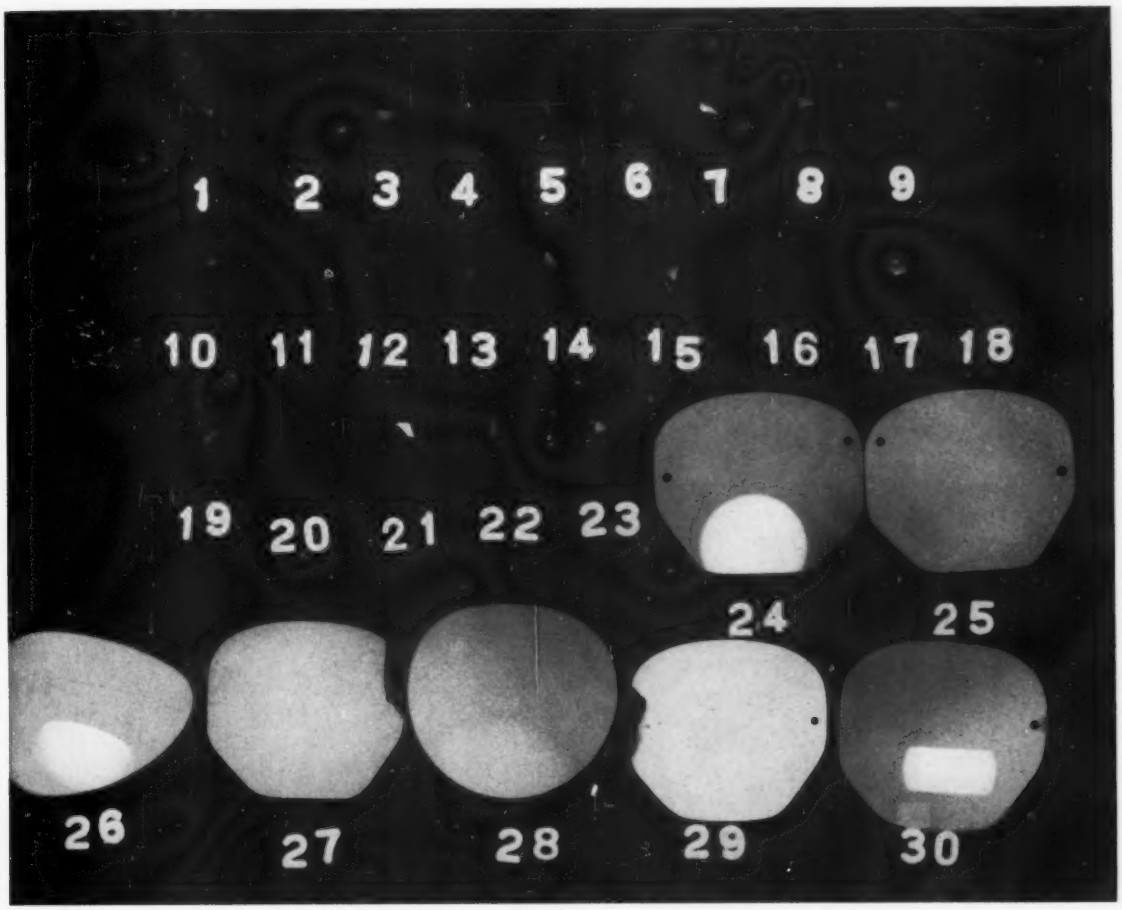


Fig. 2*A*. Mass exposure of the types of glass studied.
(The numbers are the same as in Charts 1A and 1B.)

Case 1. February 6, 1947. Mr. A. L. H., industrial worker in a mill. A piece of pipe hit the right lens of his eye glasses. There was a penetrating wound of the cornea with cataract upon admission. A small piece of glass in the anterior chamber was demonstrated on a bone free film (dental). This small piece of glass in the anterior chamber was removed with part of the cataract on February 7, 1947, by the ophthalmologists. A conventional no-screen film, the same as used for metallic foreign bodies (Fig. 1, *A* and *B*) revealed a second triangular piece of glass in the orbit. Localization showed this foreign body to be inside the eye. The surgeon was unable to remove this latter piece of glass.

Case 11. (Fig. 6.) J. C. J. (colored). Hit with coca-cola bottle. Irregular wound of cornea, prolapsed iris. Anterior chamber filled with hemorrhage. Cornea blood stained. A conventional no-screen film reveals several pieces of glass. Localization shows these fragments outside the eye in the orbital tissue. Surgical repair. Eye quiet five months after operation. Cornea clearing.

The radiopacity of the piece of lens glass (Case 1, Fig. 1, *A* and *B*) was astounding and immediately raised several questions regarding this type of foreign body. Had our technique been faulty in the past? Were all lenses used in eye glasses radiopaque? Industrial compensation and accident cases presented the problem of glass foreign bodies frequently. Needless to say, much responsibility in such cases is placed on the roentgen department.

Upon investigation, the varieties of glass used in industry were found to be many (Fig. 2, *A*, *B* and *C;* Chart 1, A and B), such as ornamental glass used in store

CHART IA

DATA FOR FIGURE 2A

	Type of Glass	Radiopacity
1	Structural glass—green	Moderate
2	Structural glass—gray	Slight
3	Structural glass—red	Moderate
4	Structural glass—peach	Slight
5	Structural glass—black	Slight
6	Structural glass—white	Slight
7	Structural glass—blue	Slight
8	Structural glass—beige	Moderate
9	Window glass—double	Moderate
10	Rib glass	Moderate
11	Plate glass (polished)	Slight
12	Crystal sheet glass	Slight
13	Safety sheet (auto)	Slight—moderate
14	Safety plate (auto)	Moderate
15	Ground glass	Slight—moderate
16	Rib wire (heat or explosion)	Slight
17	Mirror (plate)	Moderate
18	Hammered alklo	Slight
19	Hammered coolite	Slight—moderate
20	Flocentine	Moderate
21	Fluorescent bulb glass	Marked
22	Coca-cola bottle	Moderate
23	Whiskey bottle	Moderate
24	Bifocal lens	Distance lens—moderate Bifocal segment—marked
25	Bifocal lens	Distance lens—moderate Bifocal segment—moderate
26	Bifocal lens	Distance lens—moderate Bifocal segment—moderate marked
27	Plain lens	Moderate
28	Bifocal lens	Distance lens—moderate Bifocal segment—moderate
29	Bifocal lens	Distance lens—marked (1 plus) Bifocal segment—marked (2 plus)
30	Bifocal lens	Distance lens—moderate Bifocal segment—marked (2 plus)

fronts, glass used in partitions, automobile glass, etc. Industrial ornamental glass presents a hazard to the workmen during installation. Automobile glass and eye glasses may be encountered in accident cases. Frequently the question of fragments of glass bottles of various kinds is encountered, as a result of explosions or fights (Fig. 6). In the latter, the bottles are used as weapons. All of these cases present themselves for compensation or damages. The accurate demonstration of such foreign bodies or roentgenographic proof of no foreign body is extremely important to the ophthalmologist. If such intraocular glass foreign bodies can be demonstrated and cannot be removed, then enucleation is indicated to avoid a sympathetic ophthalmia. If it is proved that no glass foreign body is present inside the eye, repair of the injured eye may give the patient some hope of residual useful vision (Fig. 6). The handling of such cases with as near a precision technique as possible, in the roentgen department, is imperative.

The cooperation of a large glass dealer was enlisted to furnish samples of industrial glass. An optician furnished many types of eye glass lenses for this investigation.

The next problem in this investigation, after the collection of many glass samples, was one of arriving at not only a fairly optimum penetration for the demonstration of such foreign bodies in the patient, but also an accurate comparative penetration in a phantom. By so doing, we produce, as accurately as possible, in the phantom the same density of film as when dealing with a patient.

CHART IB

DATA FOR FIGURE 2, B AND C

	Type of Glass	Radiopacity
31	Plain lens	Slight
32	Bifocal lens	Distance—slight Bifocal segment—slight
33	Bifocal lens	Distance—marked (1 plus) Bifocal segment—marked (2 plus)
34	Bifocal lens	Distance—slight Bifocal segment—slight
35	Bifocal lens	Distance—marked (1 plus) Bifocal segment—marked (2 plus)
36	Plain lens	Moderate
37	Plain lens	Moderate
38	Plain lens	Slight moderate
39	Bifocal lens	Distance—slight moderate Bifocal segment—marked
40	Bifocal lens	Distance—slight Bifocal segment—marked
41	Plain lens	Slight
42	Bifocal lens	Distance—slight Bifocal—marked
43	Bifocal lens	Distance—slight Bifocal—marked
44	Bifocal lens	Distance—slight Bifocal segment—slight
45	Bifocal lens	Distance—slight Bifocal segment—slight
46	Bifocal lens	Distance—slight Bifocal segment—moderate
47	Bifocal lens	Distance—slight Bifocal segment—slight
48	Bifocal lens	Distance—slight Bifocal segment—marked
49	Bifocal lens	Distance—slight Bifocal—marked
50	Bifocal lens	Distance—slight Bifocal segment—marked
51	Bifocal lens	Distance—slight Bifocal segment—marked

An aluminum ladder was employed alongside a number of patients and the density of the orbital area compared with the various steps of the ladder. An average density of the orbital area of the patients was established. This orbital density varies very slightly in most individuals, except in orbital tumors, marked hemorrhage, and orbital abscesses, in sharp contrast to the proper roentgenographic factors to reproduce, with the phantom, the same orbital density as when dealing with the average patient. These factors being established, a film was made of each glass sample after embedding in the orbit of the phantom a fragment of each type of glass used in this study (Fig. 3, 4 and 5). The number and variety of such fragments

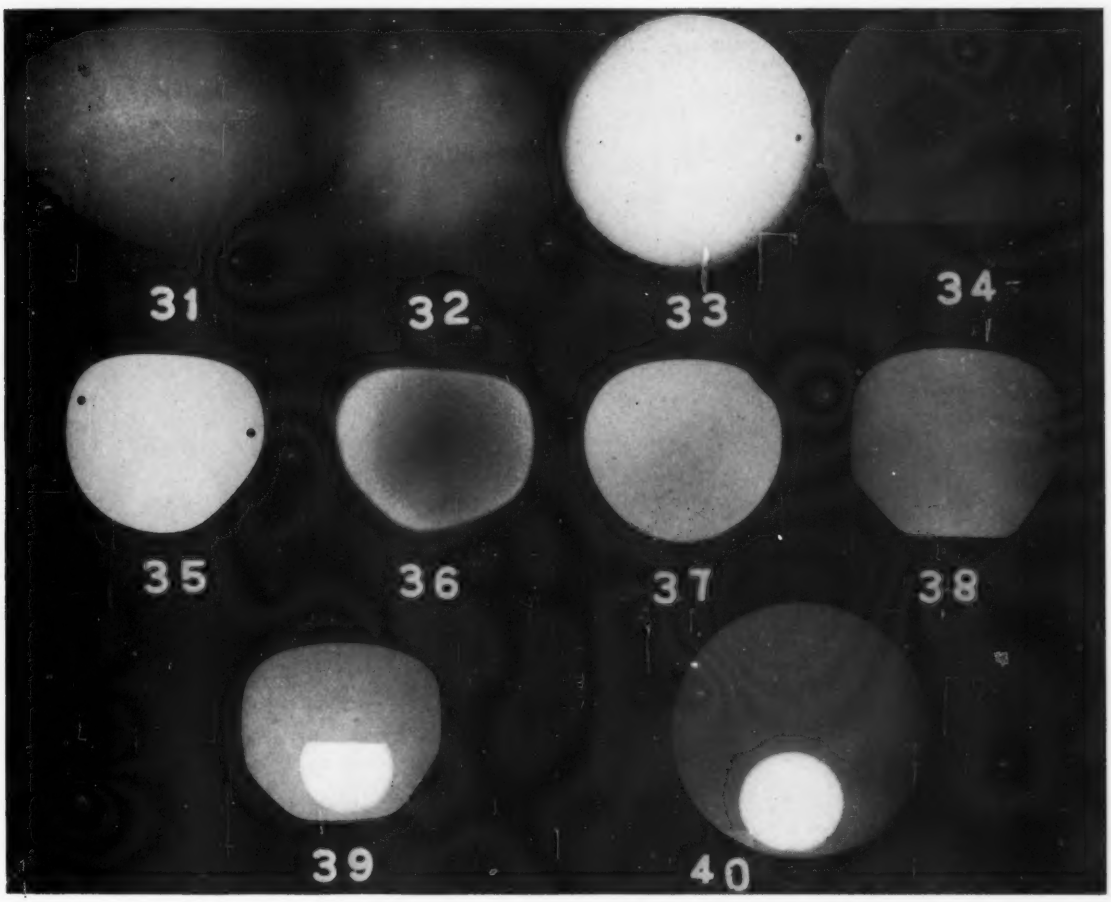


Fig. 2*B*. Same as Figure 2*A*.

variation in density found in other parts of the head.

After establishing an average penetration to work from in dealing with patients, a phantom was constructed from a portion of a skull so that many types of glass could be studied. A high melting point paraffin with a matrix of cotton fibers was used to fill the orbits and ethmoid labyrinths. Using this phantom alongside the aluminum ladder, a series of films were made to find which can be demonstrated was a startling revelation. All films made in this study obviously could not be reproduced because of space limitation. Representative films have been selected (Fig. 3, 4 and 5).

Naturally, no absolute set of factors or fixed technique can be established for the demonstration of glass in the eye of all patients who are suspected of having glass foreign bodies.

Many factors complicate this problem.

First, the size and shape of glass foreign bodies will vary tremendously. Second, the position of the glass fragment with relation to the surrounding and overlapping bony structures adds to the difficulty of demonstration. Third, even though the variation of the orbital structures is slight, this factor must be considered. Therefore, exposures for demonstrating glass fragments in the eye or orbital tissue should be made at varying angles and penetrations.

Since no absolute optimum penetration can be established for all patients, it is my routine to make lateral serial exposures starting approximately 5 kv. (peak) below the average optimum penetration. Each successive exposure should be made by increasing 2.5 kv. (peak) until reaching 2.5 kv. (peak) above the average optimum. By using a plate tunnel with lead shields on each end, two exposures can be made on one 5 by 7 inch no-screen film. This same procedure is used on exposures made at an angle as in localization films (Fig. 1 and 6). Usually at the most, not over six 5 by 7 inch films are necessary to arrive at some definite conclusions.

Figure 6 is a striking illustration as to the importance of taking films at various angles. Exposure A was made at a right angle to the vertical median plane of the head. Exposure B was made at an angle of 15 degrees; shifted caudad. The foreign body shadow of a piece of coca-cola bottle glass is extremely sharp in exposure B; while, in exposure A, the shadow is blurred; and, if only exposure A were at hand, the presence of a foreign body would be very

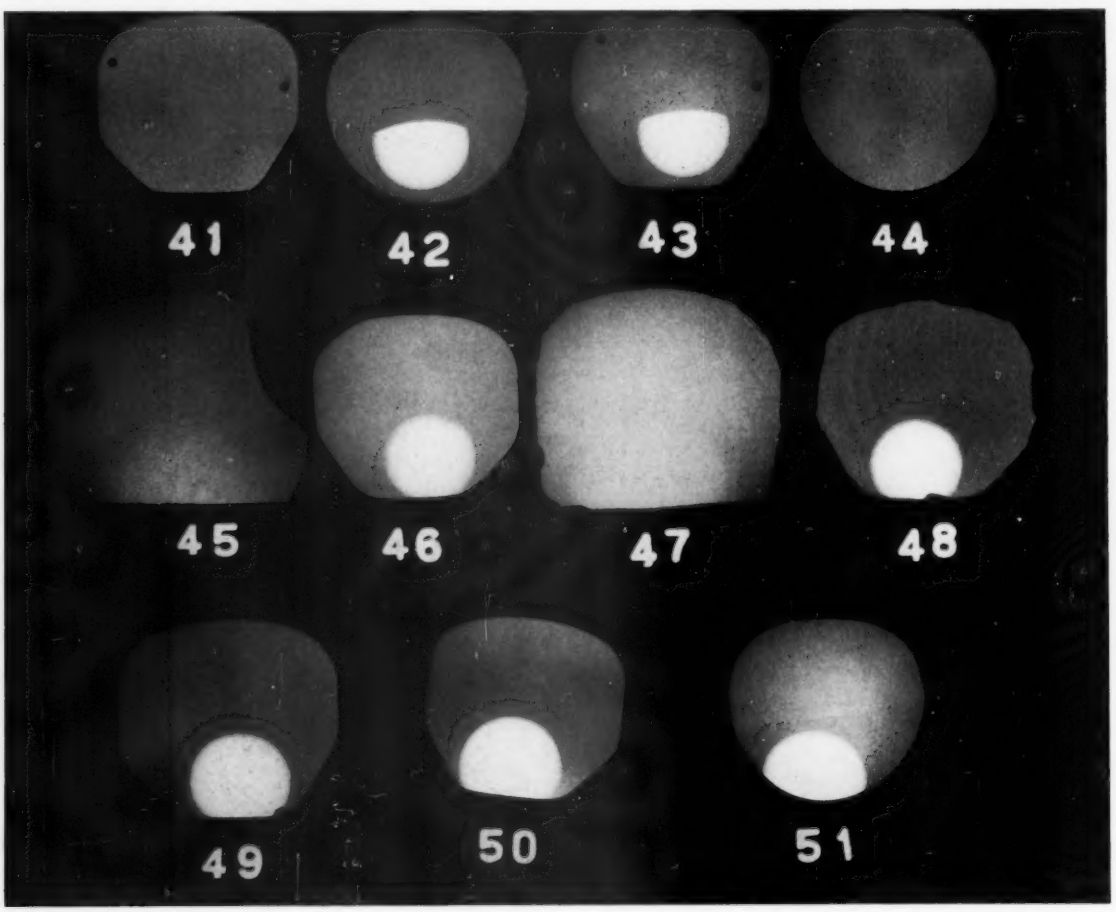


Fig. 2*C*. Same as Figure 2*A*.

Fig. 3

questionable. Along with the angle film the presence of a foreign body is certain.

This same case (Fig. 6) illustrates emphatically that size and shape play a great part as to which type of film will best demonstrate a glass foreign body with any one set of factors. The shape may be such that the ray striking at one angle produces a sharp image, while at another angle there is a haziness as if producing a penumbra. This same case (Fig. 6) had two very small glass fragments which do not show on reproduction of the roentgenograms or on all of the roentgenograms, but illustrate the value of serial exposures with varying kilovoltage. These small fragments were seen best on the films made with the lowest penetration.

By establishing a satisfactory set of roentgenographic factors for each roentgen department having to deal with such cases, a large percentage of such foreign bodies can be demonstrated.

In all of our cases with a history of glass injury to the eye in which the original roentgenograms revealed no glass foreign body but subsequent enucleation was necessary, a film was made of the enucleated eye. Then the enucleated eye was sectioned and a search made for any glass fragments. So far in this series the subsequent findings have duplicated the roentgenographic findings as to glass foreign bodies.

One interesting fact brought out during my work on glass foreign bodies is the extreme radiopacity of most of the bifocal lenses. However, some bifocal segments (28-34-44-45-47) are very little more radiopaque than the distance lens. Lenses 29-33 and 35 (bifocals) show very little difference between the distance and bifocal segments, both being very radiopaque.

There being no difference in the efficiency of the various types of lenses, it would appear that anyone, especially those in hazardous occupations, should wear the

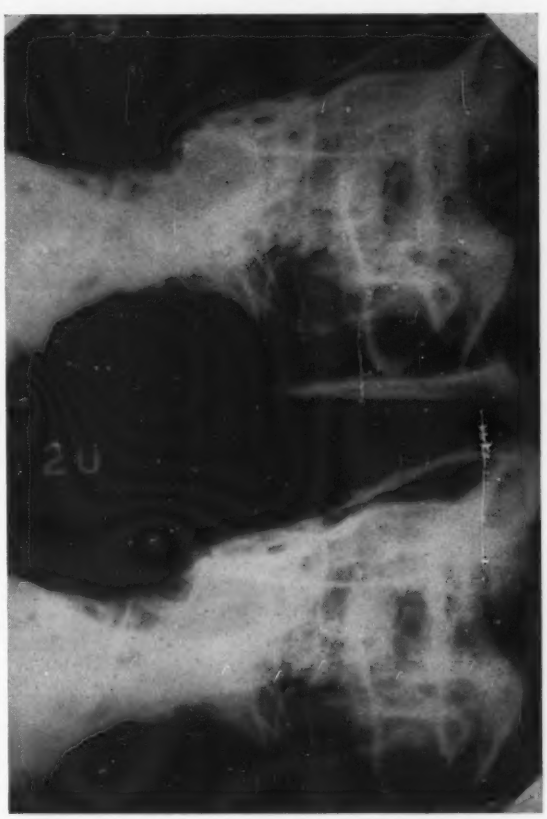
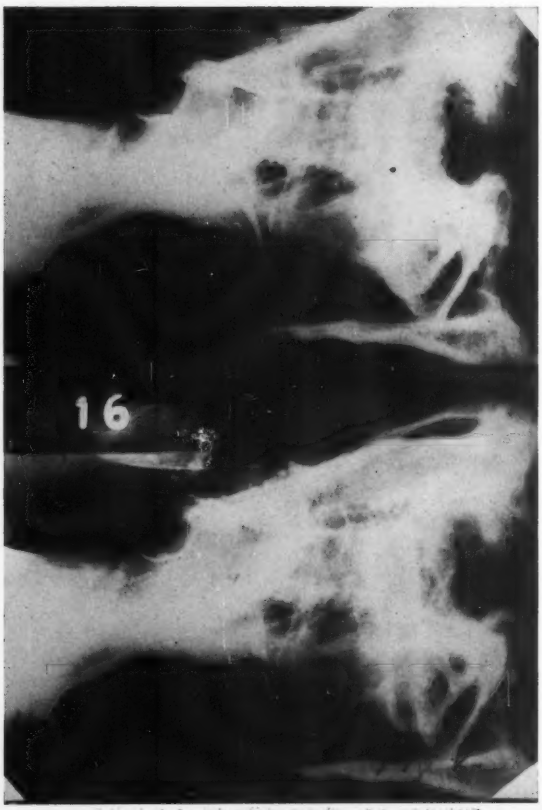


Fig. 4



most radiopaque lens (29-33-35, Fig. 2, *A* and *B*).* If these most radiopaque lenses were a requirement, an accident case would be far more certain to get an accurate opinion from the roentgen department; and, as a result, far more accurate advice from the ophthalmologist.

CONCLUSIONS

1. Figure 1 (same type of lens as sample 24, Fig. 2*A*, Chart 1) and Figure 6 (same type of glass as sample 22, Fig. 2*A*, Chart 1) illustrate, along with Figure 4 (phantom), (glass samples 19 and 20 Chart 1A), that glass fragments of even slight-moderate, and moderate radiopacity are demonstrable on a conventional no-screen film for localization.

* Names of these lenses will be furnished by the author on request of ophthalmologist.

←≪ Fig. 5

Fig. 3, 4 and 5. Films made of the phantom (the numbers correspond to those in Figure 2*A* and Chart 1).

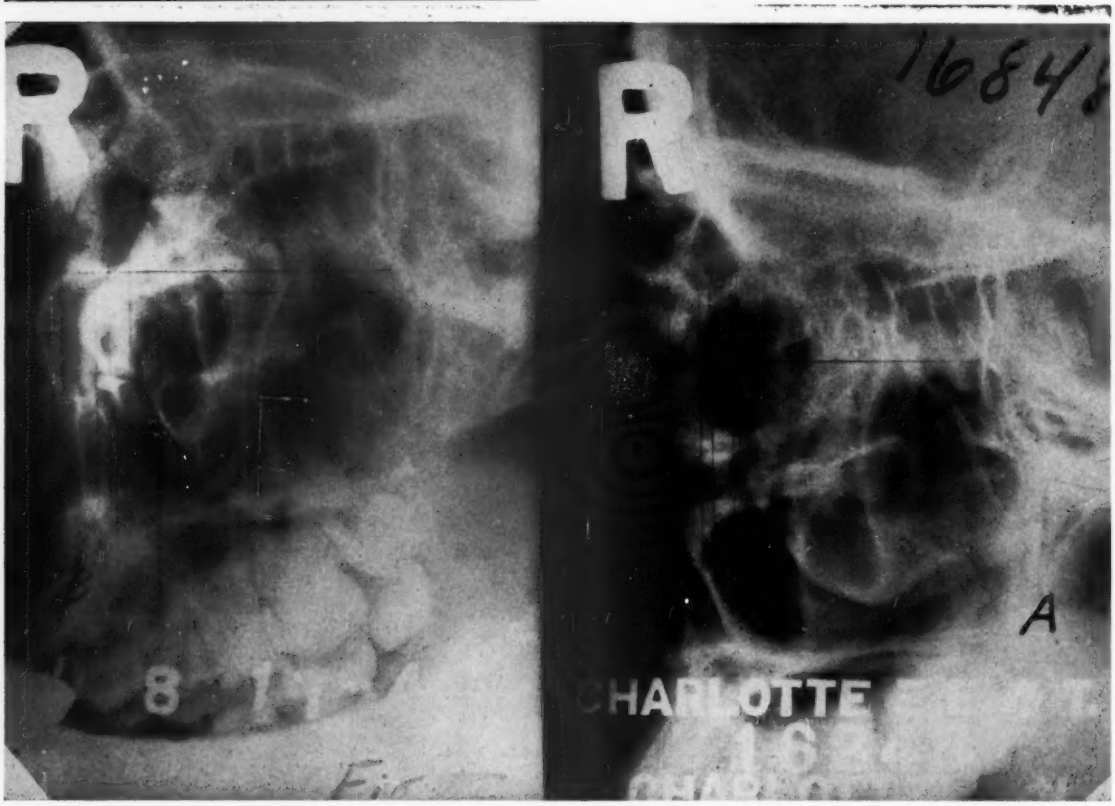


Fig. 6. Case 11. Coca-cola bottle fragments. Conventional no-screen film for localization.

2. Persons employed in a hazardous occupation should wear a lens of the most marked radiopacity (Fig. 2*A*, 29; 2*B*, 33–35).

3. Cases suspected of injury to the eye by glass fragments should have serial roentgenograms made at varying penetrations and at several angles.

4. The processing of such films should be identical and as precision like as possible to avoid over- or under-development, since the shadows are delicate even on a perfect film.

107 West 7th St.
Charlotte 2, N. C.

REFERENCES

1. Azarova, H. C. Report of two cases in which glass particles remained in eye for long periods. *Vestnik oftal.*, 1943, *22*, 38–40.
2. Gillan, R. U. Experimental radiography of small fragments of glass in relation to human eye. *Brit. J. Ophth.*, 1941, *25*, 117–122.
3. Lewis, R. W. Roentgenographic study of glass and its visibility as foreign body. Am. J. Roentgenol. & Rad. Therapy, 1932, *27*, 853–857.
4. O'Hea-Cussen, V. Removal of non-magnetic foreign bodies from vitreous. *Brit. J. Ophth.*, 1944, *28*, 296–298.
5. Thorpe, H. E. Management of nonmagnetic intraocular foreign bodies. *Surg., Gynec. & Obst.*, 1947, *84*, 809–822.

SMALL INTESTINAL RUPTURE DUE TO NON-PENETRATING ABDOMINAL INJURY

A ROENTGENOLOGICAL STUDY*

By GEORGE JACOBSON, M.D., *and* RAY A. CARTER, M.D.
School of Medicine, University of Southern California and Los Angeles County Hospital
LOS ANGELES, CALIFORNIA

A ROENTGEN examination of the abdomen has become rather standard practice when either spontaneous or traumatic rupture of a hollow intra-abdominal organ is suspected. Free gas may be demonstrated in approximately 80 per cent of the patients who have had a perforation of the stomach or the first portion of the duodenum and in almost 100 per cent of those with a perforation of the colon.[17] In reviewing the literature with reference to the perforation of the small intestine, we were impressed by the frequency with which it is stated that a roentgenogram of the abdomen is a valuable aid in the diagnosis, and the infrequency with which positive findings are described.

Rupture of the small intestine due to non-penetrating trauma of the abdomen is not a common injury and is frequently difficult to diagnose. Shock is unusual. Occasionally symptoms sufficiently severe to bring the patient to the hospital may be delayed for several hours. Associated injuries may so confuse the clinical picture that the diagnosis is unsuspected and is made only after a considerable period of time or at the autopsy table.

To study the value of the roentgen examination in rupture of the small intestine, 19 cases due to non-penetrating trauma of the abdomen are reviewed.

MECHANISM AND DISTRIBUTION

Lewis and Trimble[9] observed that a circumscribed force more often injured the intestine or kidney, whereas a diffuse force was more likely to injure the liver, spleen, pancreas, or blood vessels. They also stated that intestinal injuries were less common in the young than in the aged where the structures are relatively fixed. No relationship between age and this type of injury is apparent from our study. The ages of our patients varied from four to seventy years, with 3 under the age of ten. The average age was thirty-six.

Wilensky and Kaufman[21] cited the relationship of inguinal and other hernias to intestinal ruptures. They pointed out that a blow to the abdomen of itself might not be sufficient to cause a rupture. Reflex contraction of the abdominal wall following the blow, however, might raise the endovisceral pressure so that if the visceral wall were weakened at one point, such as the inguinal ring or esophageal hiatus, rupture of intestine lying adjacent to these areas could occur. An inguinal hernia was found in only one of our patients. While the presence of a hernia may be a factor in the production of a perforation, it appears to be comparatively unimportant in this series.

It has been stated that relatively minor injuries to the abdominal wall may cause perforations of the intestine.[1,6,9] Aristotle, as quoted by Poer and Woliver,[15] observed that, "A slight blow will cause rupture of the intestine without injury to the skin." Blows to the abdomen during street fights accounted for 8 of the perforations in this series. Seven of the patients were injured in automobile accidents. The remaining 4 suffered varying types of trauma; 2 slipped and fell against fire hydrants, 1 was struck by a piece of wood from a circular saw, and the fourth was kicked by a horse. In the majority, it is not possible to estimate accurately the severity of the blow to the abdominal wall. While only 3 had visible contusions, it is fair to assume that most were struck with at least moderate violence.

* From the Department of Radiology, School of Medicine, University of Southern California and Los Angeles County Hospital.

A crushing injury in which the external force compresses the intestine against the spine or pelvic bones is also given as a mechanism in the production of small bowel rupture.[6,15,18] Those of our patients who were injured in automobile accidents may have had a crushing type of abdominal injury. One patient was thrown from his automobile and pinned between the car and curb. This resulted in a ruptured jejunum. Another, driving while drunk, struck a telephone pole and was jammed against the steering wheel. She suffered a perforated duodenum. A six year old boy, run over by a truck, had fractures of both pubic bones associated with perforation of the terminal ileum. He also had a tear of the root of the left lung from which he died.

Greaves *et al.*,[5] studying the effects of underwater blast injuries in experimental animals, concluded that the determining factor in the production of injuries by blast was the presence of air. Segments of gut tied at both ends, filled with air, and subjected to the effects of blast ruptured, but other segments which were filled with saline solution or were collapsed did not rupture. If the gas could be displaced, they noted that there was hemorrhage into the intestinal wall but no rupture. Friedell and Ecklund,[4] who also studied blast injuries in experimental animals, found that perforations occurred over areas which contained fecal material in scybalous form and over air bubbles, i.e., colon, terminal ileum, and jejunum. In these animals, severe force was required to cause perforation which occurred immediately and was not a late result due to necrosis of the intestinal wall.

All reports in the literature agree that the segments of the small intestine most commonly involved are duodenum near the ligament of Treitz, jejunum just beyond the ligament, and ileum just proximal to the ileocecal valve. These are the relatively fixed portions of the small intestine. Counseller and McCormack[2] reviewed 1,313 cases of traumatic rupture of the intestine published between 1899 and 1935 and found that 80 per cent of such injuries occurred in the jejunum just distal to the duodenojejunal flexure and the terminal ileum, and 10 per cent each in the duodenum and large intestine. Poer and Woliver,[15] summarizing 163 cases published from 1935 to 1941, found approximately the same distribution.

The perforations in the 19 cases in this study were located as follows: *duodenum* 3, 2 in the third portion and 1 between the second and third portions; *jejunum* 7, 1 at the ligament of Treitz, 3 one foot below the ligament, and 3 between 18 inches and 4 feet from the ligament; and *ileum* 9, 8 described as being 1 to 4 feet from the ileocecal valve and 1 in the mid-ileum.

This rather constant distribution of perforations would appear to indicate that, following non-penetrating violence to the abdomen, concussion, relative fixation of the intestine at the ligament of Treitz and the ileocecal valve, and a moderately severe force are the more important etiologic factors which acting in combination rather than singly, produce rupture of the small intestine.

CLINICAL FEATURES

The symptoms, physical and laboratory findings were due primarily to peritonitis, both chemical and bacterial. Symptoms due to hemorrhage, which may play an important role in the traumatic abdomen where there is laceration of the liver, spleen, kidney, mesentery or omentum, were not evident in any of our cases. Shock, when present early, was attributable usually to other associated injuries rather than the perforated bowel per se. Later, it may have been due to a spreading peritonitis.

In the differential diagnosis, injuries to other than intraperitoneal organs, namely, retroperitoneal structures, diaphragm, and abdominal wall, should be considered. Traumatic peritonitis,[1,13] produced either by blunt shock to the celiac axis with no visceral damage or by injuries to the back or thorax with referred abdominal signs, must also be differentiated.

Associated injuries, particularly when the patient is rendered unconscious, may completely mask the intra-abdominal injury. There were 2 deaths in our series directly attributable to these associated injuries in which the ruptured intestine was discovered at autopsy, though suspected antemortem in one. Another patient who had a cerebral contusion died six days after injury without regaining consciousness. A postmortem examination showed him to have a generalized peritonitis due to rupture of the terminal ileum.

Abdominal pain was the chief complaint of all except 3 patients who died without regaining consciousness. Delayed onset of pain has been commented on in the literature[1,15] and various theories offered in explanation. It was seen in only 1 of our patients. He was involved in a street fight following which he went home and to bed only to be awakened in the early hours of the morning, approximately nineteen hours after injury, by moderately severe upper abdominal pain. The others in which there was a delay in the onset of pain had more or less obvious explanations. A child, kicked by a horse, was unconscious for one-half hour. Shortly after regaining consciousness, he complained of severe generalized abdominal pain. Two patients who had been drinking and fighting apparently could not complain of pain until they were

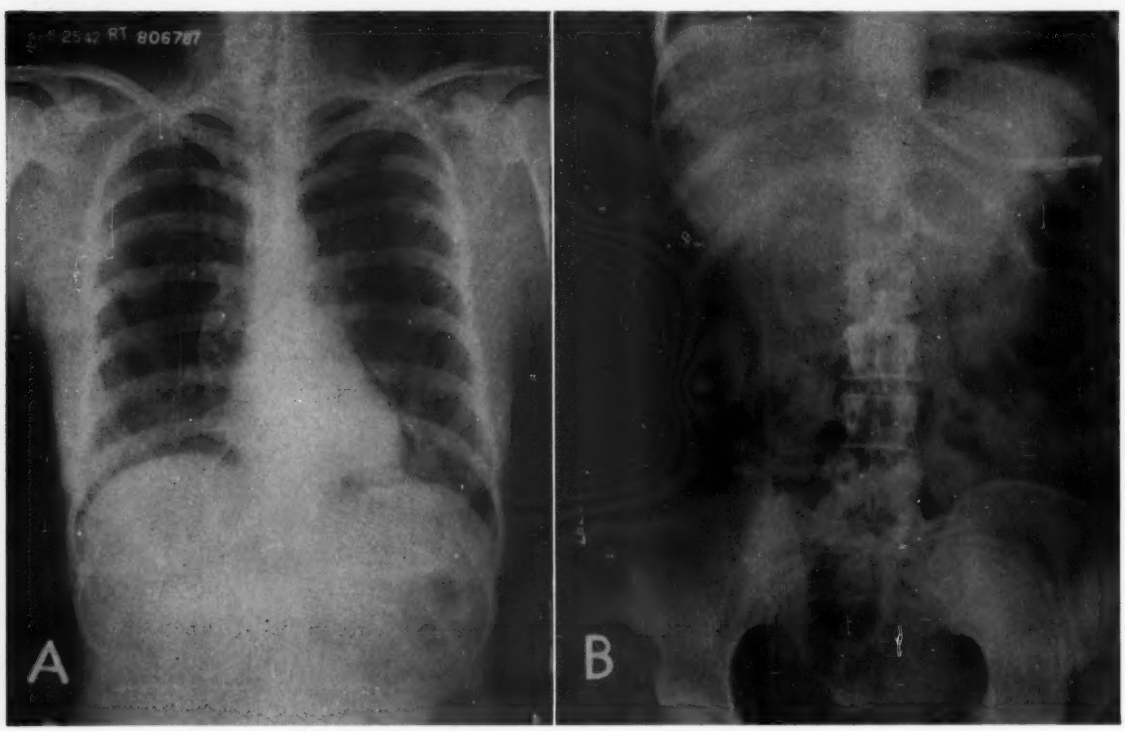


FIG. 1. *Ruptured Dudoenum.* R. E., female, aged thirty-five. Patient jammed against steering wheel when automobile she was driving struck telephone pole. Intoxicated. Not unconscious. Complained of sharp, steady, generalized, abdominal pain soon after injury. Vomited several times. *Physical examination:* Blood pressure 120/80, pulse 90, temperature 99° F. Fracture right radius. No visible abdominal injury. Generalized abdominal rigidity and tenderness. Absent peristalsis. White blood cell count 26,100 (polymorphonuclears, 91 per cent).

Roentgen examination, seven hours after injury: (*A*) No free subphrenic air. (*B*) No evidence of free air or fluid within the peritoneal cavity or retroperitoneal spaces. Note absence of visible ileus.

Operation, twenty-seven hours after injury: Large perforation between second and third portions of duodenum. Perforation at base of mesentery just beyond ligament of Treitz. Bulge in lesser omental cavity probably due to large hematoma. Plastic exudate throughout peritoneal cavity. The patient died three weeks after the accident and at autopsy was found to have an abscess behind the ascending colon.

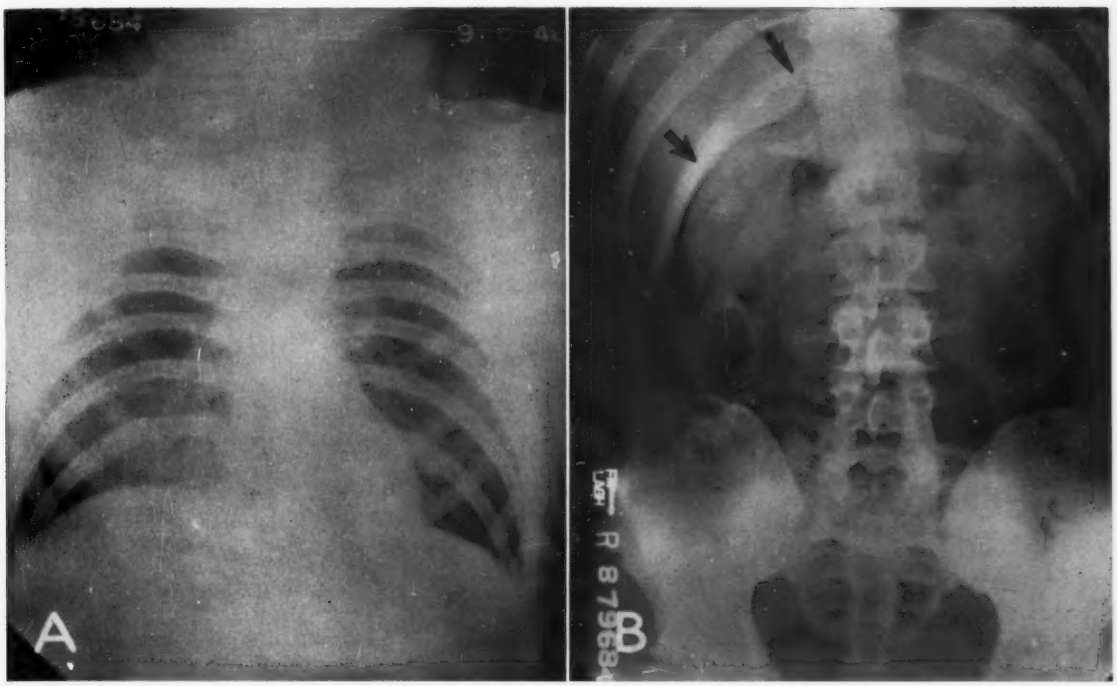


Fig. 2. *Ruptured Duodenum.* R. T., male, aged twenty-eight. Struck in abdomen and face during street fight. Not unconscious. Almost immediate onset of continuous, sharp, generalized, abdominal pain. Mild nausea but no vomiting. *Physical examination:* Blood pressure 120/80, temperature 98.2° F, pulse 64, respiration 22. Multiple facial abrasions. No visible abdominal injury. Abdomen rigid, markedly tender, and silent. Peritoneal tap: Old blood with clots. Serum amylase: 690 mg. per cent. Urinalysis negative except for 2 plus albumin and 10–15 white blood cells and occasional red blood cells per high power field. White blood cell count 23,000 (polymorphonuclears, 86 per cent).

Roentgen examination, twelve hours after injury: (*A*) No free subphrenic air. (*B*) Lower arrows point to air surrounding the right kidney. Upper arrow points to air extending upward along the crus of the right diaphragm. Only evidence of ileus is single taut segment of small intestine in the left mid-abdomen.

Operation, twenty-four hours after injury: Rupture of third portion of duodenum. Extravasation of intestinal content into the retroperitoneal spaces laterally and about the right kidney. No peritonitis described. The patient made an uneventful recovery.

sufficiently recovered from their alcoholic spree. In the remainder, pain was noted immediately or very soon after injury. Almost all, regardless of the site of rupture, described the pain as being severe, continuous and generalized. One patient with a ruptured duodenum had severe right flank pain. Two with rupture of the ileum had generalized abdominal pain which was most marked in the lower abdomen.

Nausea and vomiting were frequent. There was no real hematemesis. Some complained of an inability to urinate and others of the desire to defecate but the inability to do so.

On examination of the abdomen most had marked generalized rigidity and tenderness. In one, there was only slight rigidity and tenderness. Two others on entry were described as having "voluntary guarding" but later developed generalized rigidity and tenderness. Of particular interest was one patient who was kicked in the abdomen during a fight. Though he complained of severe generalized abdominal pain and had generalized abdominal tenderness and absent peristalsis, there was only slight rigidity which was considered to be voluntary. It was thought that the patient's symptoms were out of proportion to his physical findings and that he was either a malingerer or a narcotic addict. He died of a ruptured ileum thirty-six hours after injury.

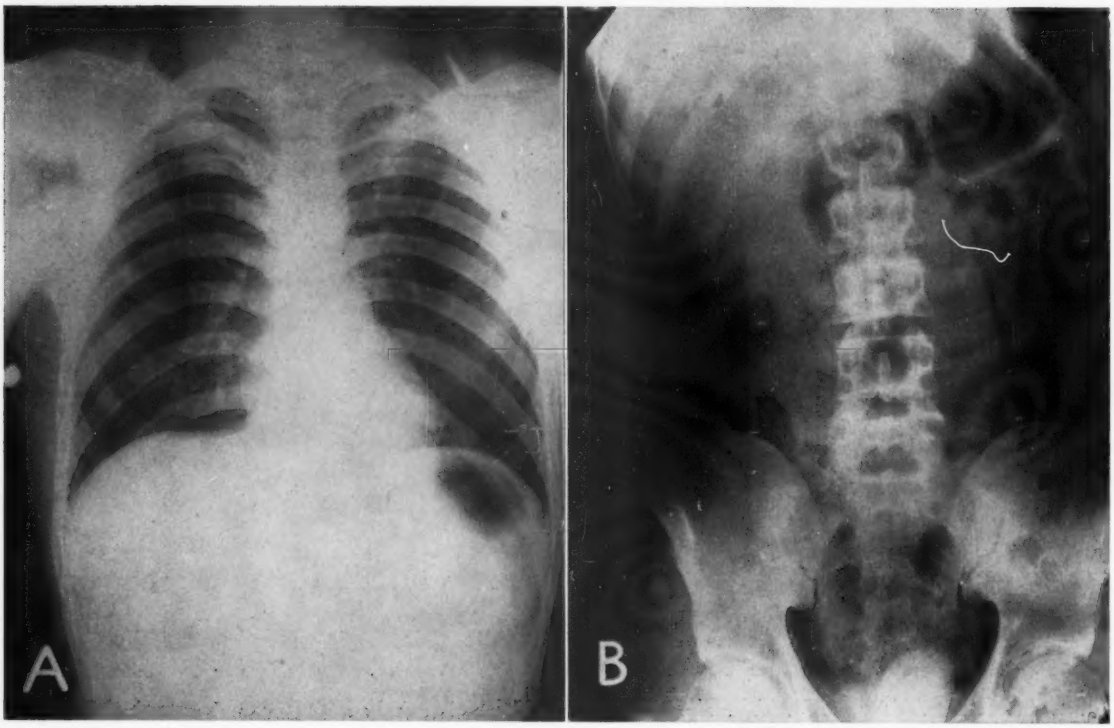


Fig. 3. *Ruptured Duodenum.* R. C., male, aged thirty-five. Pedestrian struck by automobile. Not unconscious. Taken home. Rapid onset of severe generalized abdominal pain most marked in right flank. Vomited twice. Passed grossly bloody urine. Brought to hospital five hours after injury. *Physical examination:* Blood pressure 90/70, pulse 140, temperature 98.2° F. Multiple contusions, lacerated scalp. No visible abdominal injury. Condition appeared critical. Abdomen board-like, silent. Generalized abdominal tenderness, most marked in right costovertebral angle and right lower quadrant. Gross blood in urine. White blood cell count 15,640 (polymorphonuclears, 86 per cent). Clinical picture attributed to injury of right kidney.

Roentgen examination, sixteen and one-half hours after injury: (*A*) No free subphrenic air. (*B*) Right renal and psoas shadows obliterated. Slight scoliosis of lumbar spine. No evidence of increased intraperitoneal fluid. Note presence of only a few scattered non-distended collections of small intestinal gas.

Operation, twenty-two hours after injury: Large perforation of third portion of duodenum with extensive dissection of intestinal content into the retroperitoneal spaces on the right. Peritoneal cavity contained 3,100 cc. of thin, turbid, brown fluid.

The patient died eleven days after injury. *Autopsy:* Diffuse peritonitis. Right retroperitoneal abscess extending to the lower pole of a contused right kidney. Third and fourth portions of duodenum necrotic. Contusion of transverse colon, liver, and lower right lung.

Peristalsis was either absent or markedly diminished in all cases.

The leukocyte count, in general, was elevated, ranging up to 30,800 per cu. mm. with a shift to the left.

The temperature was variable, in most cases being slightly elevated.

CORRELATION OF ROENTGEN, SURGICAL AND AUTOPSY FINDINGS

Duodenum—3 cases.

In none was there evidence of free intraperitoneal air.

Roentgenograms of the first patient (Fig. 1), taken seven hours after injury, were normal and there was no evidence of free air or fluid within the peritoneal cavity or in the retroperitoneal spaces. No definite small intestinal ileus could be identified. At surgery, twenty-seven hours after injury and twenty hours after the roentgenograms, there was a large perforation between the second and third portions of the duodenum, a perforation at the base of the mesentery just below the ligament of Treitz, and plastic exudate throughout the abdomen. A bulging mass in the lesser omental cavity was thought to be due to a large hematoma. Three weeks after injury, the patient died and was

found to have an abscess located behind the ascending colon.

Roentgen examination in the second case (Fig. 2), twelve hours after injury, showed the right kidney clearly outlined by retroperitoneal air which extended medially to the right paravertebral region and upward along the crus of the right diaphragm. A single taut gas-filled segment of small intestine was present in the left mid-abdomen. At surgery, twenty-four hours after injury and twelve hours after the roentgenograms of the abdomen, there was a large perforation of the third portion of the duodenum. The duodenal serosa was edematous and in some places almost digested. Duodenal juices extended into the retroperitoneal space laterally to the right kidney. The peritoneal cavity was dry and there was no peritonitis. The patient made an uneventful recovery.

In the third case (Fig. 3), roentgenograms made sixteen and one-half hours after injury showed obliteration of the right psoas and renal shadows with scoliosis of the lumbar spine to the left. No retroperitoneal air was seen. There were several scattered non-distended collections of small intestinal gas in the abdomen. At surgery, twenty-two hours after the injury and five and one-half hours after the roentgen examination, 3,100 cc. of thin, brown, turbid fluid were found in the peritoneal cavity. There was a large perforation of the third portion of the duodenum with several hundred cubic centimeters of similar fluid in the right retroperitoneal space surrounding the kidney and extending from the hepatic flexure to the cecum. The patient died eleven days after the accident and at autopsy was found to have a diffuse peritonitis. About a quart of foul pus was present retroperitoneally spreading over

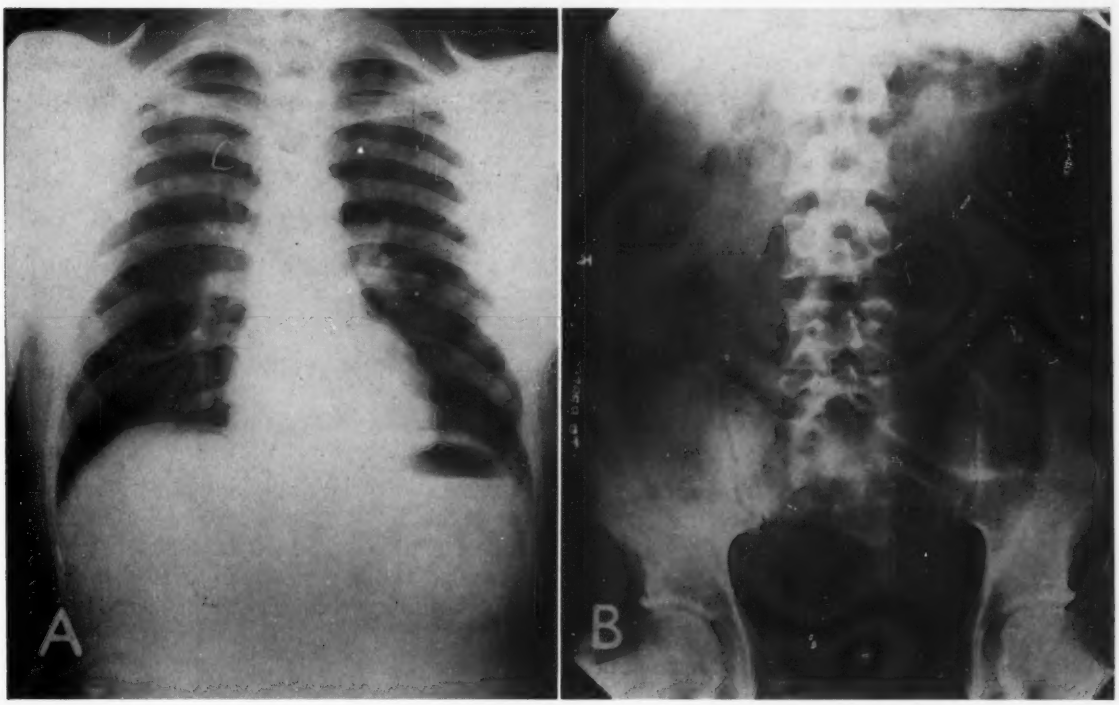


Fig. 4. *Ruptured Jejunum.* R. H., male, aged thirty. Beaten and kicked in abdomen during street fight. Not unconscious. Walked home. Nineteen hours after injury awakened by moderately severe upper abdominal pain. Vomited several times. Had desire to defecate but was unable to do so. Brought to hospital. *Physical examination:* Blood pressure 120/80, temperature 99.6° F., pulse 94. Not in acute distress. Numerous bruises about face. No visible abdominal injury. Slight generalized abdominal rigidity and tenderness in right flank. Peristalsis diminished. White blood cell count 15,300 (polymorphonuclears, 81 per cent).

Roentgen examination, twenty-three hours after injury: (*A*) Small amount of free air beneath right leaf of diaphragm. (*B*) Multiple sharply dilated segments of small intestine in the left lower abdomen, but no other abnormal findings.

Operation, twenty-six and one-half hours after injury: Rupture of jejunum 12 inches below ligament of Treitz. Severe generalized peritonitis with 1,000 cc. of purulent material in the peritoneal cavity. The patient made an uneventful recovery.

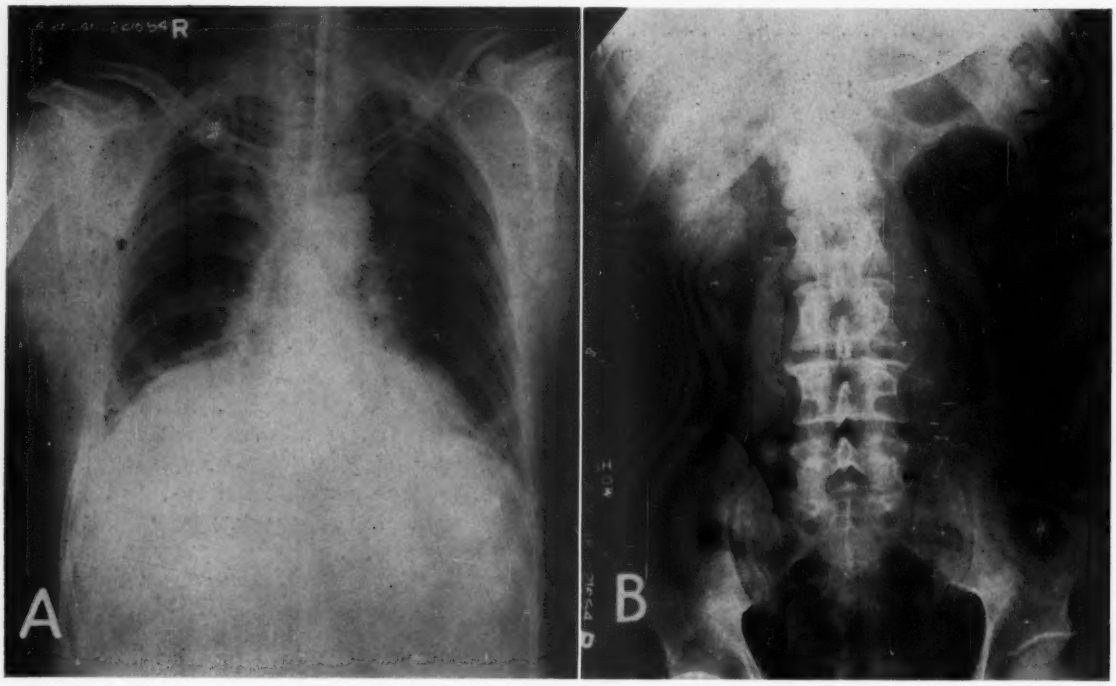


Fig. 5. *Ruptured Jejunum.* J. R., male, aged fifty. Beaten and kicked in chest and abdomen during street fight. Intoxicated. Not unconscious. Arrested and placed in jail overnight. When sober, complained of severe generalized abdominal and bilateral flank pain. Later, pain in both shoulders. *Physical examination:* Blood pressure 150/100, temperature 100.2 F., pulse 88. No visible abdominal injury. Marked abdominal rigidity and tenderness. Absent peristalsis. Urinalysis negative except for 3 to 4 red blood cells per high power field. White blood cell count 16,600 (polymorphonuclears, 92 per cent).

Roentgen examination, thirteen hours after injury: (*A*) Right diaphragm elevated but no free subphrenic air. (*B*) Scattered collections of small intestinal gas, including one taut segment in the left upper abdomen, constitute the only visible evidence of ileus. No other abnormal findings.

Operation, eighteen and one-half hours after injury: Perforation of jejunum along its antimesenteric border 18 to 24 inches below the ligament of Treitz. Approximately 1,000 cc. of upper intestinal content within peritoneal cavity. Recovery was relatively uneventful.

the lower pole of a contused right kidney. The third and fourth portions of the duodenum were necrotic. There were also contusions of the transverse colon, liver and lower right lung.

Jejunum—7 cases.

Free subphrenic air was present in only 2 cases and each was associated with ileus consisting of a few rather sharply dilated segments of small intestine. Roentgenograms of these 2 patients were made four and twenty-three hours respectively after injury. The first was operated on five hours after injury and one hour after the roentgen examination. There was found a 1 cm. perforation in the fixed portion of the jejunum at the ligament of Treitz. A moderate amount of bloody exudate and scattered food particles were present throughout the peritoneal cavity and there was a generalized peritonitis. The patient died on the operating table. The second (Fig. 4) had surgery twenty-six and one-half hours after injury and three and one-half hours after the roentgen examination. There was a large perforation of the jejunum 12 inches below the ligament of Treitz. The peritoneal cavity contained 1,000 cc. of purulent material and there was a severe generalized peritonitis. The patient made an uneventful recovery.

Four patients showed no evidence of free intraperitoneal air. Ileus, in 3 of these patients, was characterized by a few scattered nondistended small intestinal segments with an occasional taut coil (Fig. 5). In the fourth patient, there was no visible ileus. Roentgenograms of these patients were made three and one-half, seven, thirteen and twenty-three and one-half hours after injury. Surgery was performed thirteen, sixteen, eighteen and one-half

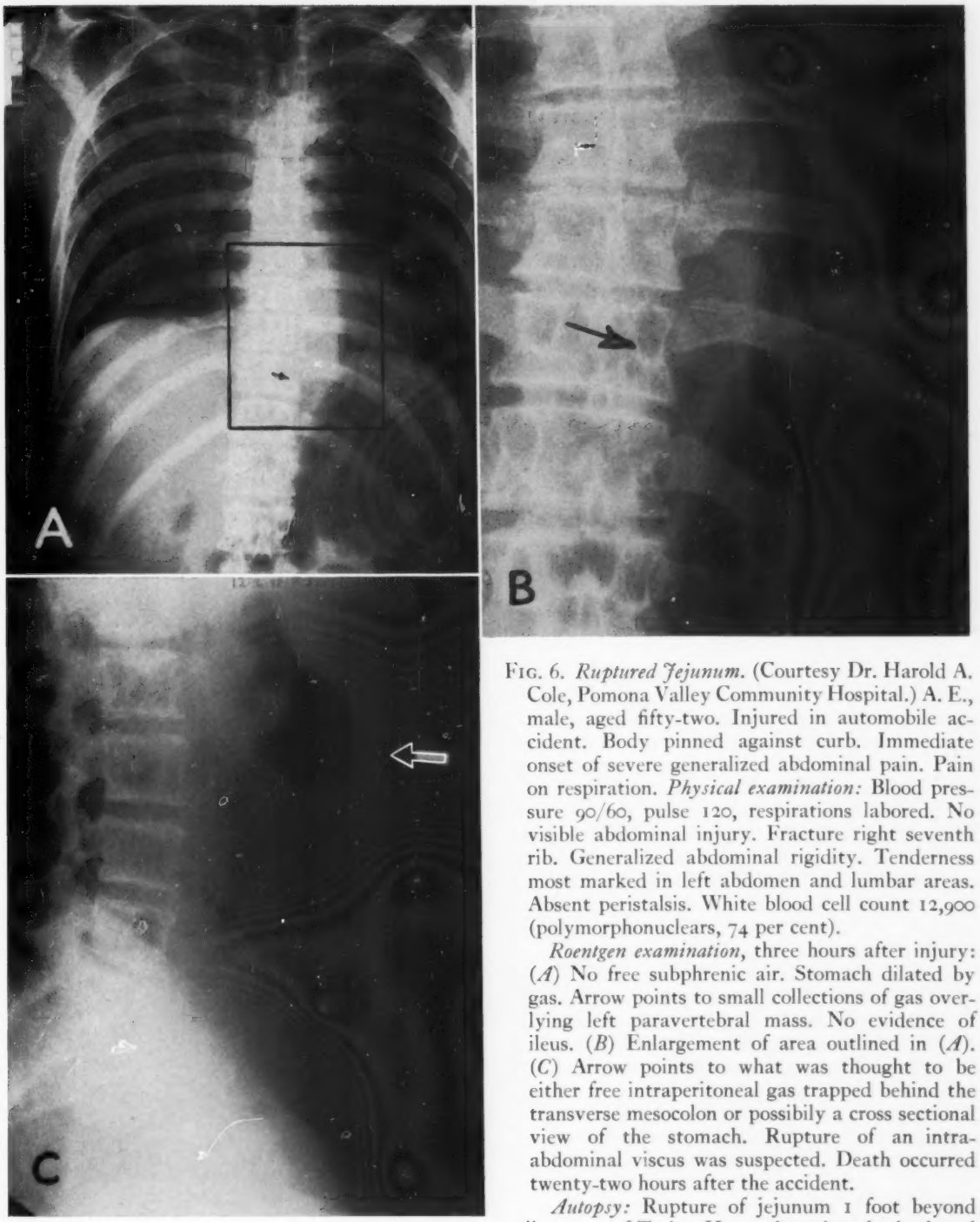


Fig. 6. *Ruptured Jejunum.* (Courtesy Dr. Harold A. Cole, Pomona Valley Community Hospital.) A. E., male, aged fifty-two. Injured in automobile accident. Body pinned against curb. Immediate onset of severe generalized abdominal pain. Pain on respiration. *Physical examination:* Blood pressure 90/60, pulse 120, respirations labored. No visible abdominal injury. Fracture right seventh rib. Generalized abdominal rigidity. Tenderness most marked in left abdomen and lumbar areas. Absent peristalsis. White blood cell count 12,900 (polymorphonuclears, 74 per cent).

Roentgen examination, three hours after injury: (*A*) No free subphrenic air. Stomach dilated by gas. Arrow points to small collections of gas overlying left paravertebral mass. No evidence of ileus. (*B*) Enlargement of area outlined in (*A*). (*C*) Arrow points to what was thought to be either free intraperitoneal gas trapped behind the transverse mesocolon or possibily a cross sectional view of the stomach. Rupture of an intra-abdominal viscus was suspected. Death occurred twenty-two hours after the accident.

Autopsy: Rupture of jejunum 1 foot beyond ligament of Treitz. Hemorrhage into both pleural cavities. The paravertebral mass was caused by a collection of blood about aorta, apparently due to rupture of a small artery. Hemorrhage into both adrenals. Death was attributed to the associated injuries and not directly to the ruptured jejunum.

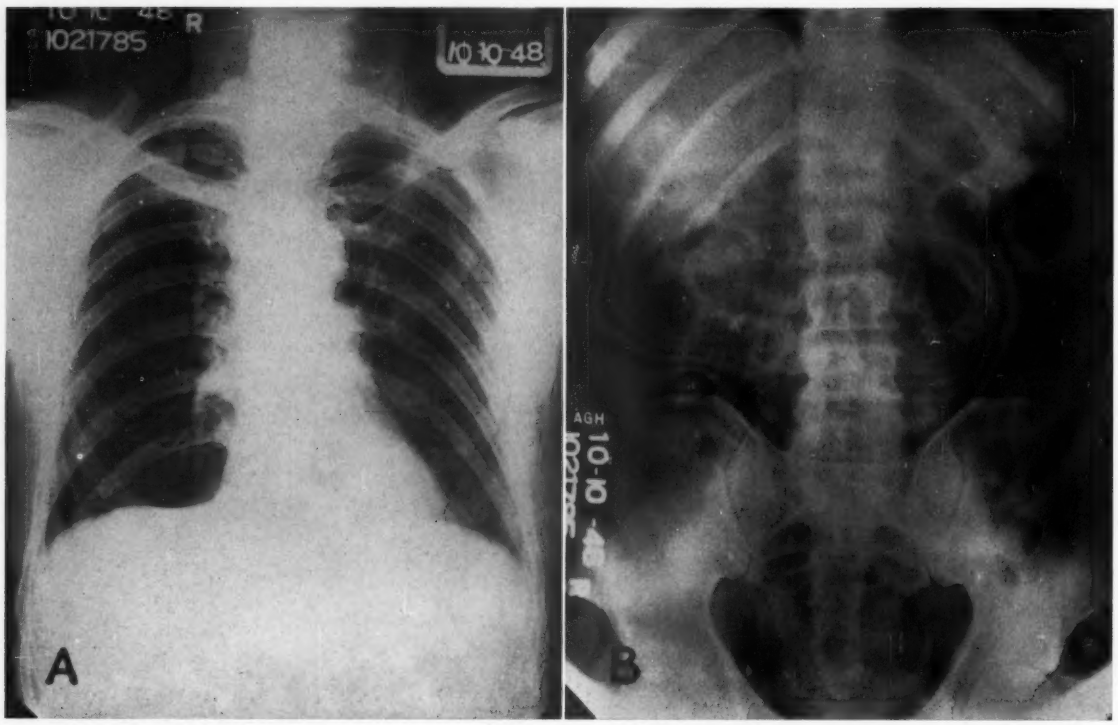


FIG. 7. *Ruptured Ileum.* J. C., male, aged fifty-nine. Struck in abdomen while intoxicated. Did not know whether or not he lost consciousness. Early onset of severe generalized abdominal pain, most marked in the right lower abdomen. Brought to hospital approximately twelve hours after injury. *Physical examination:* Blood pressure 60/50, pulse 110, temperature 99° F. No visible abdominal injury. Abdomen rigid and slightly distended. Marked generalized abdominal tenderness, particularly in the right lower quadrant. Peristalsis greatly diminished. White blood cell count 19,600 (polymorphonuclears, 84 per cent).

Roentgen examination, twelve hours after injury: (*A*) No free subphrenic air. (*B*) Ileus indicated by scattered distended segments of small intestine. Incidental calcified mesenteric lymph nodes but no other significant findings.

Operation, sixteen and one-half hours after injury: Irregular perforation of ileum 3½ to 4 feet proximal to ileocecal valve. Several pieces of undigested vegetable matter in peritoneal cavity. Peritonitis involving many folds of small intestine and anterior peritoneal wall. Recovery was relatively uneventful.

and twenty-four and one-half hours after injury and all had comparatively similar findings. The peritoneal cavities contained from 1 to 3 quarts of intestinal fluid and there was generalized peritonitis. Each had a large perforation of the jejunum located from 12 inches to 4 feet below the ligament of Treitz. All recovered.

In the remaining case (Fig. 6), roentgen examination three hours after injury showed the stomach and duodenal bulb distended with air. Small collections of air were seen extending along the left border of the spine, from the eleventh to twelfth thoracic vertebrae, just below the diaphragm. There was a narrow left paravertebral mass extending from the sixth thoracic to the first lumbar vertebrae. An ovoid collection of gas measuring 4 by 8 cm. in diameter lying opposite the second and third lumbar vertebrae in the posterior half of the abdomen was thought possibly to represent a collection of free intraperitoneal gas behind the transverse mesocolon. It was also considered that this might be the stomach seen in cross section. No air was visible under either leaf of the diaphragm and there was no evidence of ileus. The following day the paravertebral mass was larger. The stomach was displaced medially by a soft tissue mass. No free intraperitoneal or retroperitoneal air was now visible. The left thorax was filled with fluid. The patient died twenty-two hours after injury and at autopsy was found to have a rupture of the jejunum 1 foot beyond the ligament of Treitz. A collection of blood about the thoracic aorta due to rupture of a small blood vessel accounted for the paravertebral mass. There was a 3 inch laceration in the liver. The autopsy, performed

by the coroner, made no mention of the remainder of the abdomen. Both pleural cavities were filled with blood.

Ileum—9 cases.

No free subphrenic air was present in the 7 patients who had roentgenograms of the chest taken in the upright position nor was free intraperitoneal air recognizable on the roentgenograms of the abdomen in any of the cases. Visible ileus was present in 7 of the 9 patients and was similar to that seen in those with duodenal and jejunal perforations; namely, minimal scattered small intestinal gas with an occasional distended segment (Fig. 7).

Six patients were operated upon. The roentgen examinations in these were made two, two and one-half, six and one-half, nine, ten and twelve hours and the surgery of the corresponding cases five and one-half, four, eight, nineteen, sixteen and sixteen and one-half hours after injury. All presented perforations of the distal ileum, 8 inches to 4 feet from the ileocecal valve. A generalized peritonitis was found in 5 of the patients with varying amounts of fluid and fibrinous exudate. In the sixth case no mention was made of peritonitis. One patient died of sepsis and shock on the first postoperative day. The other 5 patients made relatively uneventful recoveries.

The diagnosis of perforation of the small intestine in the remaining 3 patients was not made clinically. The first was examined two hours and died six and one-half hours after having been run over by a truck. Postmortem examination revealed a complete severance of the ileum 10 inches from the ileocecal valve, fracture of the pelvis and a retroperitoneal hemorrhage, and a tear of the root of the left lung with hemorrhage. The second, thought to be a malingerer or narcotic addict, was examined approximately twenty-four hours after having been kicked in the abdomen and died twelve hours later. He was found to have a 1 inch laceration of the mid-ileum and an acute

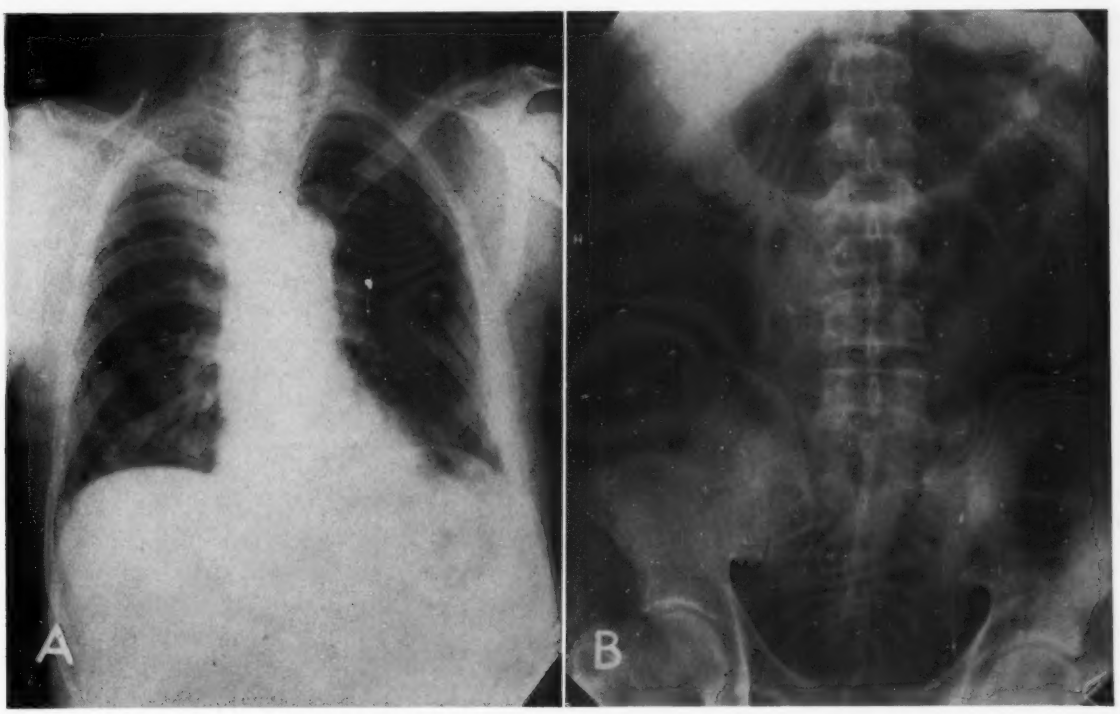


Fig. 8. *Ruptured Ileum.* W. M., male, aged sixty-seven. Struck by automobile. Unconscious. *Physical examination:* Comatose. Contusion lower right abdomen. Laceration, 10 cm. in length, left posterior parietal region. Right pupil larger than left. Abdomen moderately rigid with generalized tenderness. Peristalsis diminished. Clinically thought to have cerebral contusion.

Roentgen examination, five and one-half hours after injury: (*A*) No free subphrenic air. (*B*) Stomach distended by gas. Few scattered non-distended segments of small intestine only evidence of ileus. The patient developed signs of pneumonia and died six days after the accident without regaining consciousness. *Autopsy:* Contusion of right lower abdominal wall with rupture of underlying terminal ileum. Generalized acute peritonitis.

generalized peritonitis with considerable pus. The third patient (Fig. 8) died without regaining consciousness six days after being struck by an automobile. Roentgen examination was performed five and one-half hours after the accident. At autopsy there were two perforations of the terminal ileum underlying an area of contusion on the anterior abdominal wall and a generalized acute peritonitis.

DISCUSSION

Traumatic retroperitoneal rupture of the duodenum has been diagnosed rarely by roentgenologic means. Sperling and Rigler[20] in 1937 reported what they believed to be the first such case. A nineteen year old boy had been kicked in the abdomen twenty hours before admission to the hospital. Roentgenograms showed no free intraperitoneal air. There was air in the form of bubbles and striations about the right kidney. The patient was treated conservatively and made an uneventful recovery. Ottenheimer and Gilman,[14] and Somogyi[19] reported 1 case each of retroperitoneal rupture of the duodenum with outlining of the kidney by air. Jacobs, Culver and Koenig[7] reported 2 cases both due to blows across the back. In the first, there was no free air or retroperitoneal emphysema. At autopsy there was a rupture of the anterior wall of the third portion of the duodenum with an extravasation of duodenal content about the right kidney and iliopsoas muscle extending downward to the brim of the pelvis. The second case showed air along the left paravertebral space, through the diaphragm, presumably along the great vessels, to the inferior mediastinum. While the case was not proved surgically and the patient made an uneventful recovery, the authors felt reasonably certain of the diagnosis. Koenig and Culver[8] described a similar distribution of gas in a case of retroperitoneal perforation of a duodenal ulcer. Jacobs, Culver and Koenig[7] list the following possible routes of extension of material extravasated through a retroperitoneal perforation of the duodenum: (1) along the root of the transverse mesocolon; (2) along the root of the mesentery of the small intestine; (3) along both and in the intervening space; (4) over the right (rarely the left) kidney; (5) downward along the root of the mesentery of the ascending colon and cecum (clinically this may simulate and occasionally has been diagnosed as appendicitis or appendiceal abscess); (6) downward along the psoas muscle to the brim of the bony pelvis or to Poupart's ligament, simulating a psoas abscess; (7) along the great vessels through the diaphragm into the inferior mediastinum.

The 3 cases of retroperitoneal rupture of the duodenum included in this report demonstrate most of the various roentgen manifestations which may be encountered; no evidence of either retroperitoneal air or fluid (Fig. 1); retroperitoneal air about the right kidney extending to the paravertebral region and then upwards along the crus of the diaphragm (Fig. 2); and obliteration of the right kidney and psoas shadows associated with scoliosis of the spine due to retroperitoneal extravasation of duodenal juices (Fig. 3). Just as air has been described extending to the left rather than to the right, there is no reason to suppose that obliteration of the left renal and psoas shadows could not occur, depending on the exact location of the perforation. Obliteration of the renal and psoas shadows may be produced also by trauma to the kidney or to a retroperitoneal hematoma and should be considered in the differential diagnosis.

Discussing ruptures of the upper jejunum, Massie[11] in 1924 pointed out that the transverse mesocolon and omentum may form an effective barrier to the upward escape of gas unless it is of large quantity, which is usually not the case, and that therefore a localized collection of gas may appear on the left near the body of the second lumbar vertebra. He described a case of rupture at the duodenojejunal junction in which there was just such a collection of gas which he assumed to be trapped behind the transverse mesocolon. In the case illustrated by Figure 6, in which there was a rupture of the jejunum 1 foot beyond the ligament of Treitz, small collections of air were seen extending along

the left border of the spine from the eleventh to the twelfth thoracic vertebrae and a larger collection, similar to that described by Massie,[11] which may have been air trapped behind the transverse mesocolon.

Gas was observed under the diaphragm in only 2 of the jejunal and in none of the ileal or duodenal perforations. This, in spite of the fact that most of the roentgen examinations were performed a considerable number of hours, up to twenty-four, after injury. Free intraperitoneal air would, of course, not be expected in retroperitoneal rupture of the duodenum. In 14 cases of traumatic rupture of the small intestine due to non-penetrating injuries, Ficarra[3] found only 4 with free air; 2 had perforations of the jejunum; 1 of the ileum, examined 6 days after injury; and 1 of the first portion of the duodenum.

Mendle[12] found no free air in 4 cases of ruptured jejunum; Poer[16] reported free air in 1 case of ruptured jejunum; and only 1 of 4 jejunal perforations reported by Bunch[1] showed free intraperitoneal air. Commenting on the presence of free gas in perforations of the small intestine, Rigler[17] stated that he had been unable to observe any in at least 4 cases of traumatic perforation. In 3 cases in which he saw free subphrenic air an obstructive lesion had been present before perforation allowing a large accumulation of gas within the intestine. Except in infants, gas is not normally visualized in the small intestine, and that which is present is intimately mixed with the intestinal content. It is not surprising, therefore, that in perforations of previously healthy small intestine, as in non-penetrating trauma to the abdominal wall, evidence of free intraperitoneal gas should be the exception rather than the rule.

Gas may accumulate in the small intestine of the adult to the point of roentgen visibility due to a number of conditions: any injury, fright, the giving of intravenous medication, pain such as biliary or urinary tract colic, etc., and in particular, peritonitis. Considering the generalized and sometimes severe peritonitis that was described in almost all of the cases in this series and in general the relatively long time interval between the injury of the patient and the roentgen examination, only a comparatively minor degree of small intestinal ileus was visible in the majority of patients. In others, none was present. There was no evidence of significant colonic ileus in any of the patients. No adequate explanation of this is apparent to the authors, nor to the best of their knowledge has it been previously commented upon. These findings are in sharp contrast to those found in examinations of the abdomen where other acute surgical conditions are suspected. In infectious peritonitis, there is usually very obvious small and large intestinal ileus with loops of intestine distended by gas and fluid. Ileus is an outstanding feature of mesenteric thrombosis and may be an important part of the picture of acute pancreatitis. A ruptured peptic ulcer is usually followed before long by frank ileus. Again, as a rule, in acute small intestinal obstruction the small intestinal distention by gas and fluid is spectacular.

There were 8 deaths out of a total of 19 patients. Three died of postoperative complications and 1 died during surgery. Rupture of the small intestine was unrecognized in 4 instances. The death of 2 of these patients could be attributed to severe associated injuries. The failure to make the correct diagnosis accounted for the remaining 2 deaths. One patient was suspected of being a malingerer or narcotic addict and the other was thought to have only a cerebral contusion. Both had perforations of the terminal ileum. Undoubtedly the absence of the conventional roentgen manifestations of rupture of the intestine, free intraperitoneal gas and significant ileus contributed to this failure.

The findings in traumatic rupture of the small intestine due to non-penetrating injury of the abdomen are surprisingly obscure. Given the history of an injury calculated to produce such rupture, a negative or equivocal roentgen examination gives no assurance of safety whatsoever.

Radiologists accustomed to more overt signs in other acute abdominal conditions are apt to be deceived by the apparent innocence of the abdominal roentgenogram.

SUMMARY

1. Nineteen cases of rupture of the small intestine due to non-penetrating injury of the abdomen are presented, including a discussion of etiologic factors and clinical features.

2. Retroperitoneal perforation of the duodenum was manifested by:

(a) Outlining of the kidney by gas which also extended along the vertebral column and the crus of the diaphragm;

(b) Obliteration of the renal and psoas shadows by the retroperitoneal extravasation of duodenal content;

(c) No positive roentgen findings.

3. Free subphrenic gas was demonstrated in only two cases of ruptured jejunum and in none of the ileum.

4. Trapping of gas behind the transverse mesocolon may have been present in one case of ruptured jejunum.

5. Small intestinal ileus of only a comparatively minor degree was visible in a majority of the patients in spite of the presence of a generalized peritonitis in almost every case and a considerable lapse of time between the injury and the roentgen examination.

6. The marked paucity of positive findings makes the roentgen examination of the abdomen of little value in excluding perforations of the small intestine following non-penetrating abdominal injuries.

1200 North State St.
Los Angeles 33, Calif.

REFERENCES

1. Bunch, J. R. Intestinal perforations due to non-penetrating abdominal trauma. *South. M. J.*, 1944, *37*, 717–722.

2. Counseller, V. S., and McCormack, C. J. Subcutaneous perforation of jejunum. *Ann. Surg.*, 1935, *102*, 365–374.

3. Ficarra, B. J. Traumatic perforations of small intestine due to non-penetrating abdominal injuries. *Surgery*, 1944, *15*, 465–475.

4. Friedell, M. T., and Ecklund, A. M. Experimental immersion blast injury. *U. S. Nav. M. Bull.*, 1943, *41*, 353–363.

5. Greaves, F. C., Draeger, R. H., Brines, O. A., Shaver, J. S., and Corey, E. L. Experimental study of underwater concussion. *U. S. Nav. M. Bull.*, 1943, *41*, 339–352.

6. Hunt, G. H., and Bowden, J. N. Rupture of intestine caused by non-penetrating trauma of abdominal wall. *Arch. Surg.*, 1944, *49*, 321–326.

7. Jacobs, E. A., Culver, G. J., and Koenig, E. C. Roentgenologic aspects of retroperitoneal perforations of duodenum. *Radiology*, 1944, *43*, 563–571.

8. Koenig, E. C., and Culver, G. J. Retroperitoneal perforation of duodenum. *Radiology*, 1947, *48*, 164–167.

9. Lewis, D., and Trimble, I. R. Subcutaneous injuries of abdomen. *Ann. Surg.*, 1933, *98*, 685–697.

10. Massie, G. Traumatic intestinal rupture. *Lancet*, 1923, *2*, 640–644.

11. Massie, G. Note on diagnostic value of x-ray examination in traumatic intestinal rupture. *Lancet*, 1924, *1*, 895–896.

12. Mendle, R. A. Perforation of bowel following non-penetrating abdominal trauma. *Permanente Found. M. Bull.*, 1945, *3*, 186–192.

13. Meyer, K., and Shapiro, P. Treatment of abdominal injuries. *Internat. Abstr. Surg.*, 1938, *66*, 245–257.

14. Ottenheimer, E. J., and Gilman, R. L. Rupture of retroperitoneal duodenum. *New England J. Med.*, 1940, *222*, 251–253.

15. Poer, D. H., and Woliver, E. Intestinal and mesenteric injury due to nonpenetrating abdominal trauma. *J.A.M.A.*, 1942, *118*, 11–15.

16. Poer, D. H. Rupture of intestine through intact abdominal wall. *Bull. U. S. Army M. Dept.*, 1946, *5*, 231–233.

17. Rigler, L. G. Roentgen diagnosis of acute abdominal conditions. University of Minnesota.

18. Shipley, A. M., and Hamrick, J. C. Abdominal catastrophes resulting from external violence. *Am. J. Surg.*, 1938, *42*, 524–554.

19. Somogyi, G. Röntgendiagnose eines retroperitoneal perforierten Zwölffingerdarmgeschwürs. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1941, *63*, 221–225.

20. Sperling, L., and Rigler, L. G. Traumatic retroperitoneal rupture of duodenum; description of valuable roentgen observation in its recognition. *Radiology*, 1937, *29*, 521–524.

21. Wilensky, A. O., and Kaufman, P. A. Subparietal rupture of intestine due to muscular effort; complication of hernia. *Ann. Surg.*, 1937, *106*, 373–393.

Vol. 66, No. 1

DUODENAL, AMPULLARY AND PERI-AMPULLARY CARCINOMA*

WITH THREE CASE REPORTS

By ARCHIE SHEINMEL, M.D.,† *Chief of the Radiological Service, and*
ARNOLD JOFFE, M.D., *Associate Radiologist*
Department of Radiology, Bronx Veterans Hospital
BRONX, NEW YORK

IN THE course of observation of a great number of malignant lesions of the gastrointestinal tract, it is not at all unusual to encounter the rarer types occurring in the second part of the duodenum and in the head of the pancreas. When they are found a sufficient number of times, it is possible to make reasonable assumptions as to the histopathological type of lesion, even when the clinical findings and roentgenograms of the different lesions are similar. This is particularly true when the neoplastic lesions occur in or about the second part of the duodenum.

When the clinical and roentgenographic data are correlated, one can diagnose various carcinomatous lesions of the duodenal sweep with a degree of accuracy not readily appreciated in the medical literature.

Three cases, each of different histopathological entity, are presented. The differential diagnostic points are emphasized, after correlating the clinical and roentgenographic observations.

Primary cancer of the duodenum is relatively infrequent, constituting approximately 0.25 per cent of all carcinomas and about 3 per cent of intestinal carcinomas. Carcinoma may occur in any portion of the duodenum. The second portion is most frequently involved in about 60 per cent of the cases. The first portion is next most frequently involved in about 25 per cent of the cases; the third portion in 15 per cent of the cases. Adenocarcinoma arising from the mucosa constitutes 90 per cent of the cases.

In carcinoma of the second portion of the duodenum, the usual clinical symptoms may include any or all of the following: epigastric distress, high icteric index, nausea and vomiting, weight loss, secondary anemia, occult blood in the stools, and red blood cells in the duodenal drainage.

Roentgenographically, carcinoma of the duodenum produces several distinctive patterns. Since the lesion originates in the mucosa, it produces pressure from within the lumen. The duodenal sweep does not change. The duodenal lumen may be widened locally by the growing tumor. The mucosal pattern is drastically altered, and becomes destroyed and grossly irregular. Generally speaking, a primary duodenal carcinoma, because of its more variable luminal location will grow to a large size before producing pressure on the ampulla, and thus jaundice clinically. It may not occlude the duct at all.

If the growth is papillary, it will distort the adjacent mucosa by direct contiguous pressure. On roentgenoscopy, and in serial roentgenograms, there is noted constancy and stiffness of the distorted irregular mucosal pattern. It may even produce gastric and duodenal retention. These changes are well exemplified in Case 1 (Fig. 1).

CASE 1. This is a white male, aged sixty, who was first admitted to the Bronx Veterans Administration Hospital in 1941 because of intermittent fever and chills. The only positive finding was an enlargement of the liver four fingers below the costal margin. Roentgenographic examination consisted of gallbladder series, gastrointestinal series, and barium enema All showed no abnormal findings.

* From the Department of Medicine and Surgery, Veterans Administration Hospital, Bronx, N. Y. Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

† Deceased.

The patient was admitted six months later because of right upper quadrant pain, and at operation a dilated thickened gallbladder, free of stones, was removed. The patient was well thereafter until February, 1948, when he was treated by his local physician for what was described as an upper respiratory virus infection. He had what appeared to be complete recovery, only to develop pruritus about three weeks later. Two weeks after the development of the pruritus, he became clinically jaundiced, and there was a 15 pound weight loss in the preceding six months.

He was therefore admitted again in March, 1948, for painless jaundice.

Physical Examination on Admission. This

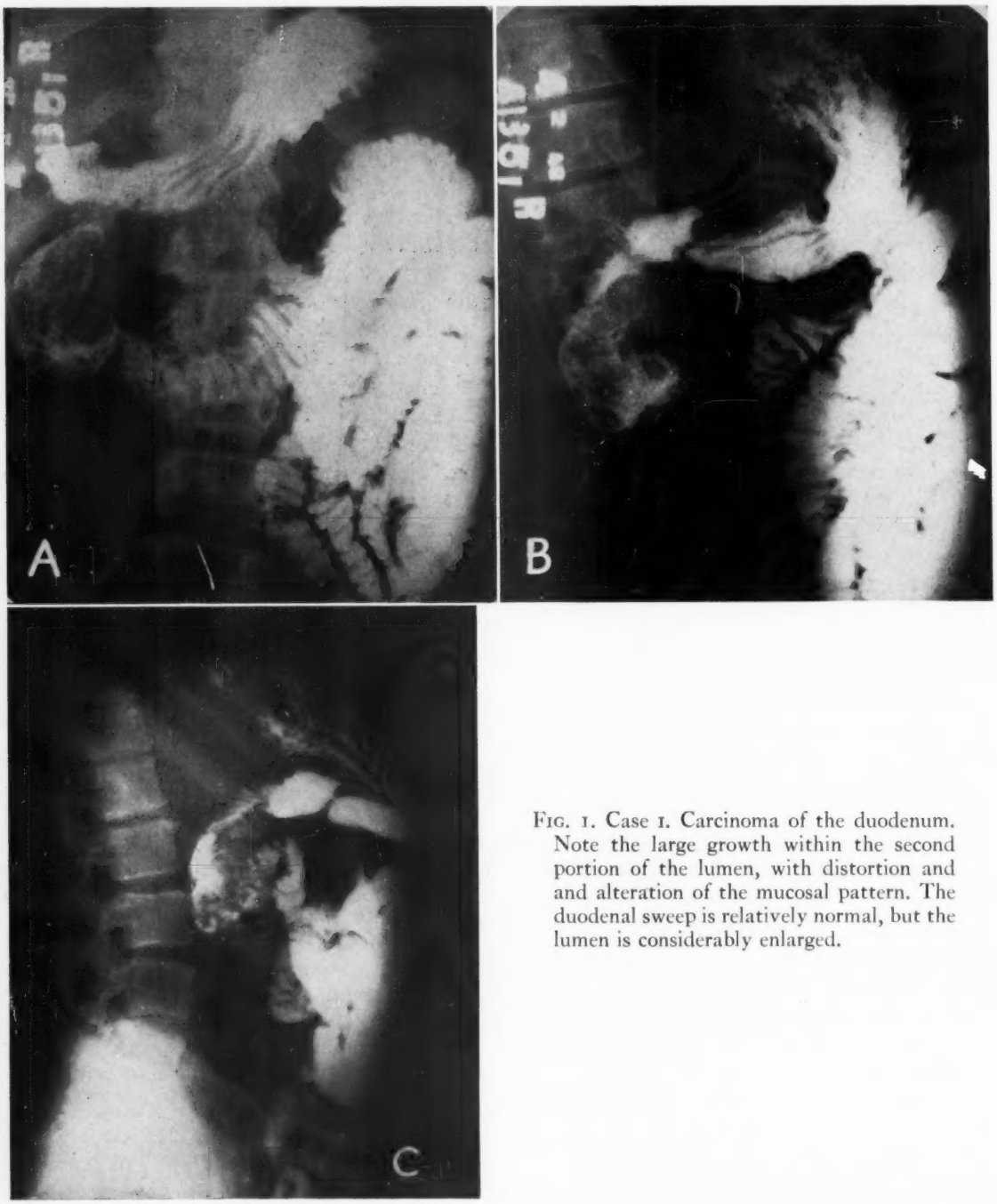


FIG. 1. Case 1. Carcinoma of the duodenum. Note the large growth within the second portion of the lumen, with distortion and and alteration of the mucosal pattern. The duodenal sweep is relatively normal, but the lumen is considerably enlarged.

demonstrated a moderately well nourished, jaundiced white male. There was a palpable mass continuous with the liver deep in the epigastrium. The liver was enlarged to four fingers below the coastal margin.

Laboratory Findings. The red and white blood cell counts were normal. There was occult blood present in the stool on occasions. The icteric indices ranged between 40 and 45; the serum phosphatase between 10 and 18. The van den Bergh tests were positive. There was gross blood in the samples of duodenal drainage.

Roentgen Findings (Fig. 1). The second portion of the duodenum is widened by an intrinsic mass distorting and altering the mucosal pattern. On roentgenoscopy and serial roentgenograms, the duodenal sweep remained normal, but was relatively fixed in position. Preoperative diagnosis was carcinoma of the duodenum.

Course. The jaundice gradually increased and a laparotomy was performed two weeks after the last admission to the hospital. A large cauliflower-like mass was palpated in the region of the second portion of the duodenum (Fig. 2). A portion of intestine 18 cm. long containing the mass was excised and removed.

Pathological Report. The specimen consists of a previous sectioned piece of small intestine 18 cm. long and 5 cm. in circumference. Eccentrically located, there is a fungating mass in the mucosa which reaches a maximum longitudinal diameter of 7.5 cm., a maximum transverse diameter of 4.5 cm., and an elevation of approximately 3 cm. There are two orifices in this mass which are marked by applicator sticks, and which, when opened, continue into dust-like structures, neither of which appears grossly bile stained. The serosal surface is pale pink and moderately injected. Microdiagnosis: Adenocarcinoma of the descending portion of the duodenum (Fig. 2).

Comment. This case demonstrates the large size that a duodenal carcinoma can attain before producing clinical symptoms. The presence of a large duodenal intrinsic neoplastic mass, without enlargement or alteration of duodenal sweep and associated with late jaundice, should make one suspect the presence of primary duodenal neoplasm.

In carcinoma of the ampulla, in contradistinction to carcinoma of the duodenum, the ampullary orifice is blocked sooner, and therefore clinical jaundice becomes manifested earlier. Roentgenographically, whenever a small intrinsic lesion is seen in the second portion of the duodenum, with early clinical jaundice, an ampullary lesion should be suspected instead of a duodenal carcinoma. This is well borne out in Case II (Fig. 3).

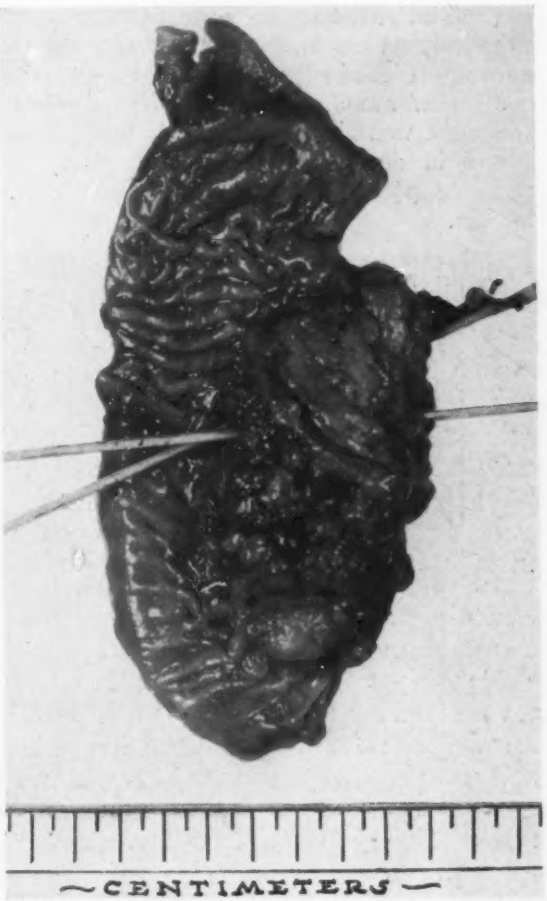


Fig. 2. Case I. Carcinoma of the duodenum: a large cauliflower mass in the region of the second portion of the duodenum. Note that the lumens of the pancreatic duct and the common bile duct are free from disease.

Case II. This thirty-eight year old Negro first noticed the onset of nausea, jaundice, and dark urine in July, 1944, while in the Army. He was treated for infectious hepatitis by the Army physicians with penicillin, but with no response. Prior to the onset of jaundice in July, he had intense pruritus for several months.

He was admitted to the Veterans Administration hospital on December 1, 1945, for the above unrelieved symptoms.

Physical examination on admission demonstrated a well developed and well nourished Negro in no acute distress. The liver was palpable $3\frac{1}{2}$ fingers below the right costal margin.

Laboratory Findings. The leukocyte count ranged between 10,000 and 12,000. The differential count demonstrated 85 per cent polymorphonuclears with several early segmented forms. The Wassermann and Kahn reactions were negative. The icteric index was 42. The van den Bergh test was direct positive. The acid phosphatase was 4.7 and the alkaline

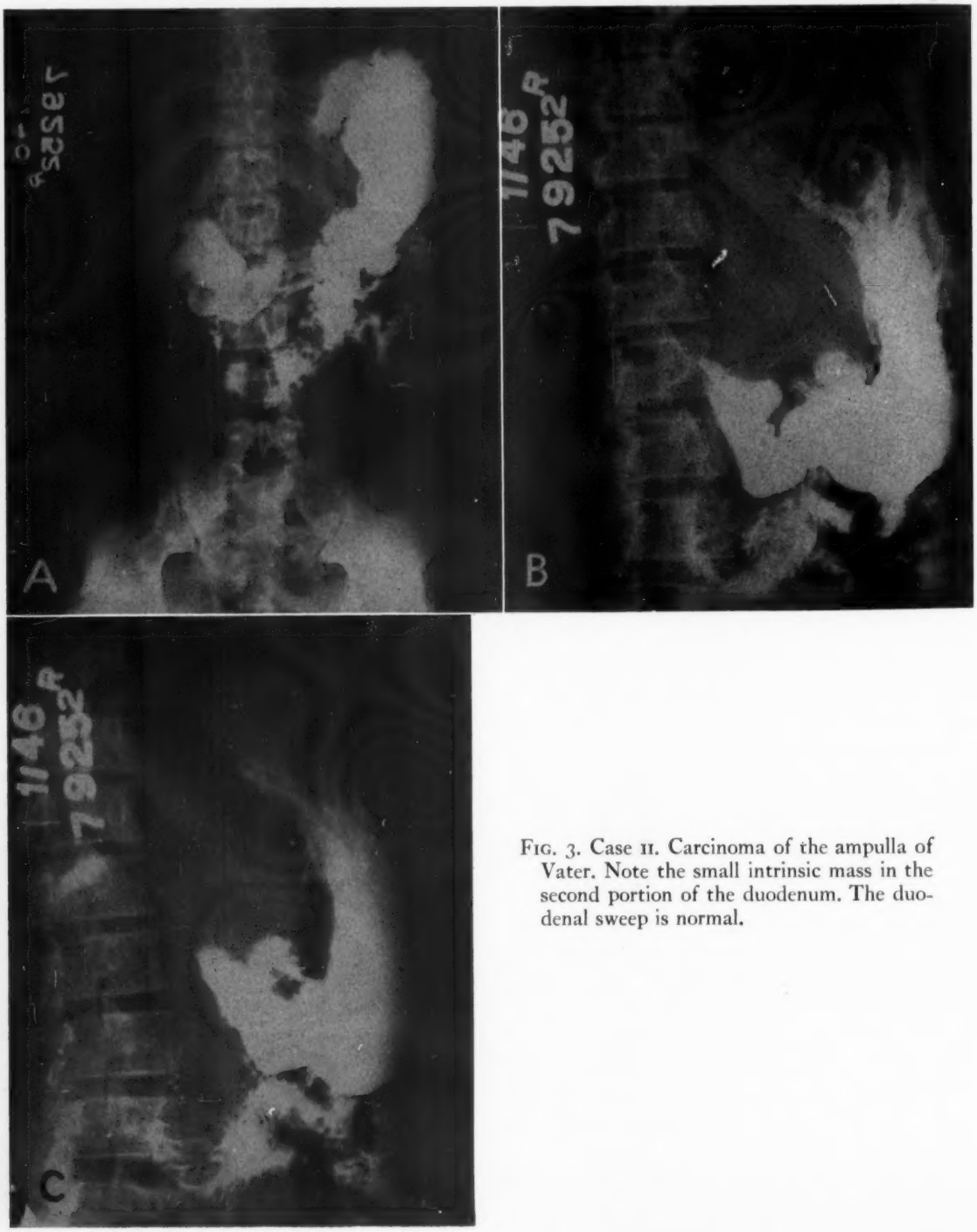


FIG. 3. Case 11. Carcinoma of the ampulla of Vater. Note the small intrinsic mass in the second portion of the duodenum. The duodenal sweep is normal.

phosphatase was 32.0. A Graham test demonstrated non-visualization of the gallbladder.

Roentgen Findings. The stomach and duodenal bulb appeared normal; the duodenal sweep was within normal limits. In the distal end of the second part of the duodenum, there was a crescentic filling defect along the medial surface about 4 cm. in the longest diameter. The mucosal pattern in the same region was distorted and destroyed. The roentgen diagnosis suggested a possible ampullary neoplasm.

Course in Hospital. There was minimal progressive increase in all the clinical signs of an obstructive jaundice. There were occasional episodes of chills and fever. He was operated upon within two weeks of his hospital admission.

Operative Findings. A laparotomy demonstrated an enlarged liver down to the umbilicus. The gallbladder was enlarged and contained approximately 200 cc. of a slightly diluted green bile. In the ampullary region of the duodenum could be palpated two masses, one approximately 3.5 cm. and the other approximately 1.5 cm. in diameter (Fig. 3 and 4).

The duodenum was then incised and a tumor mass rather smooth in outline and covered with a mucous membrane 3.5 cm. in size involving the ampulla of Vater was found. It involved and surrounded the terminal end of the common bile and accessory pancreatic ducts; both of these structures were readily visualized. There was no invasion of the duodenal walls. The entire tumor was circumscribed and movable within the duodenum.

On the medial wall of the duodenum, about midway between its anterior and posterior surface, was a second nodule, similar in appearance to the other but approximately 1.5 cm. in size. On probing this, it was found to involve the ampulla of the pancreatic duct. These were both excised.

Pathological Report. Both tumor masses demonstrated anaplastic cells, which were present in glandular formation. Microscopy showed adenocarcinoma of the ampulla of Vater.

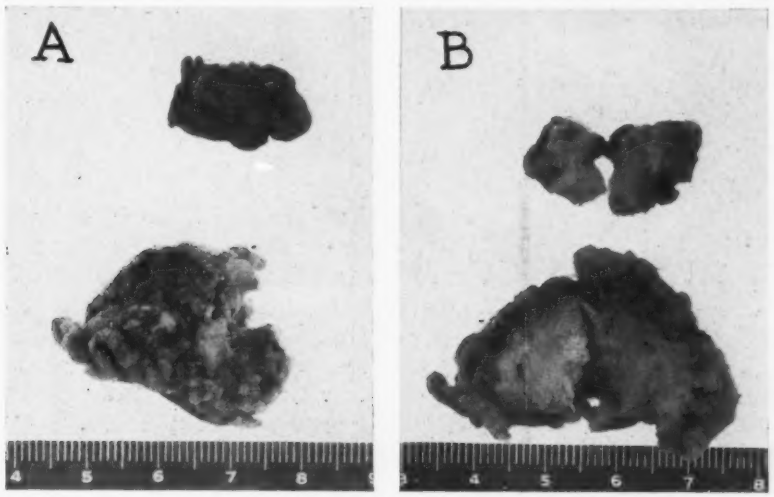


Fig. 4. Case 11. Carcinoma of the ampulla of Vater. Note the two masses, one involving the ampulla of Vater and the other the pancreatic duct.

Comment. In this case, the relatively short history of progressive jaundice and the roentgenographic evidence of a small intrinsic duodenal lesion in the region of the ampulla of Vater, without alteration of duodenal sweep, demonstrates the diagnostic criteria necessary to recognize an ampullary neoplasm.

In carcinoma of the head of the pancreas, the clinical and roentgen findings are entirely different. Jaundice usually occurs late in the course of the disease because the neoplasm primarily involves the head of the pancreas and as it grows, becomes extensive enough to invade the duodenum and adjacent ampulla. Roentgenographically, the growth exerts pressure from without the duodenum, spreading, pushing and often invading outward

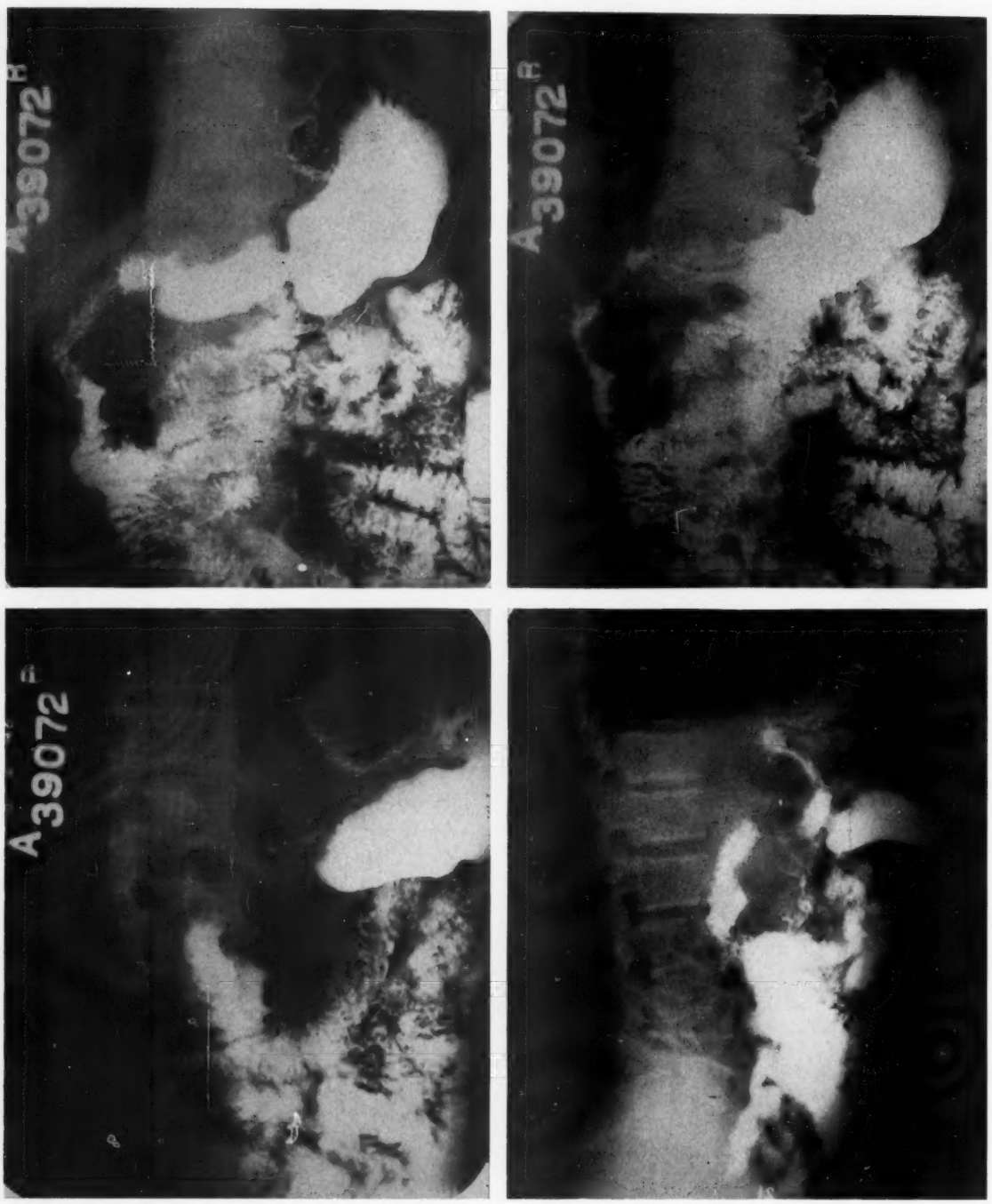


Fig. 5. Case III. Carcinoma of the head of the pancreas. There is enlargement of the duodenal sweep, and the inverted "3" effect is well demonstrated. There is no enlargement of the duodenal lumen, but there is evidence of extrinsic pressure against the duodenum.

from a focus in the pancreas. The second portion of the duodenum is fixed. The duodenal sweep is widened and the free limbs of the "u" are separated; the antral prepyloric portion of the stomach may be elevated and pushed anteriorly. The mucosal pattern of the duodenum displays evidence of extrinsic pressure defects. It is flattened out, lengthened, and the lumen is narrowed and compressed. Then, in later stages, the carcinoma invades the mucosa and the adjacent ampulla. The most fixed portion of the duodenum in the region of the ampulla is held in place, and in time an inverted "3" effect (Frostberg's sign) may occur.

Case III. This is a fifty-six year old Italian male who first noticed symptoms in January, 1947, when he began to lose weight, dropping from 190 pounds to 150 pounds in sixty days, and began complaining of some vague abdominal pain. In May, 1947, he became jaundiced, developed severe itching, and his urine became dark and his stools clay colored. He was hospitalized at another hospital for three weeks and the diagnoses which were suggested at that time were (1) pancreatic tumor or (2) cholelithiasis. He was finally discharged with the last diagnosis after his stools became normal and the jaundice less severe.

However, he continued to have abdominal pain and vomiting every three to four weeks. In October, 1947, the itching reappeared, the stools became clay colored and jaundice was noticed. He became weaker, developed polyuria and nocturia every hour.

He was admitted to the Bronx Veterans Administration Hospital in November, 1947.

Physical Examination on Admission. The salient findings demonstrated a well developed, chronically ill thin white male, with moderate icterus and a dark skin showing excoriations. The abdomen was flat, with a soft liver palpable three finger-breadths below the costal margin.

Laboratory Findings. The icteric indices ranged between 20–25.6; the van den Bergh test was positive. The alkaline phosphatase ranged between 6–22 units. The urobilinogen was strongly positive in the urine. The stools were positive for blood. Sugar was discovered on urinalysis. On admission he was given a diabetic diet and insulin, but his diabetes was never controlled.

Roentgen Findings. On roentgenoscopy, there was intolerance to the barium flow in the duodenum with rapid passage of barium through a fixed, widened loop. The roentgenograms demonstrated a large duodenal loop with inverted "3" effect, and irregularity and distortion of the mucosal pattern in the second portion. There was narrowing of the duodenal lumen. In the right lateral recumbent position, the antral portion of the barium-filled stomach was displaced more anteriorly than normal (Fig. 5).

Operative Findings. The patient was operated upon on November 9, 1948, and a hard indurated mass was found in the head of the pancreas, indenting and narrowing the medial surface of the first and second portions of the duodenum.

Pathological Report. Adenocarcinoma of the head of the pancreas with metastases to the local lymph nodes and duodenum.

Comment. This case illustrates the well known findings of carcinoma of the head of the pancreas; namely, an extrinsic pressure defect distorting the duodenum from the adjacent head of the pancreas, and there is fixation of the duodenum and enlargement of the sweep. There is late clinical jaundice. The roentgen findings are entirely different from those of intrinsic duodenal carcinoma.

SUMMARY AND CONCLUSIONS

Three illustrative cases of carcinoma in and about the duodenum have been presented; namely, carcinoma of the duodenum, carcinoma of the ampulla of Vater, and carcinoma of the head of the pancreas. The differential diagnostic roentgen and clinical criteria are emphasized.

(1) Carcinoma of the duodenum and carcinoma of the ampulla of Vater both produce characteristic intrinsic filling defects of the duodenum.

(2) In both there is an alteration of the mucosal pattern with varying degree of widening of the duodenal lumen. The neoplasm produces the changes wholly within

the lumen, in contradistinction to carcinoma of the head of the pancreas which increases the width of the duodenal sweep, and narrows the duodenal lumen by its extrinsic pressure effects and in later stages by invasion.

(3) Carcinoma of the ampulla of Vater will produce clinical symptoms earlier than carcinoma of the duodenum because of its location and intimate relationship to the distal end of the common duct. An intrinsic filling defect in the second portion of the duodenum will be noticed earlier roentgenographically than in a carcinoma of the duodenum, and the lesion will be smaller than a carcinoma of the duodenum when first noticed. Therefore, carcinoma of the ampulla will offer a better prognosis since the diagnosis can be made earlier and when the lesion is operable.

Arnold Joffe, M.D.
Veterans Administration Hospital
130 West Kingsbridge Road
Bronx 63, N. Y.

REFERENCES

1. BRUNSCHWIG, A., and TEMPLETON, F. E. Roentgenographic diagnosis of neoplasms of periampullary region and head of pancreas. *Radiology*, 1943, *41*, 438–443.
2. CASE, J. T. Roentgenology of pancreatic disease; Caldwell lecture, 1939. AM. J. ROENTGENOL. & RAD. THERAPY, 1940, *44*, 485–518.
3. HARTZELL, H. V. Case of carcinoma of duodenal bulb diagnosed preoperatively. *Radiology*, 1942, *39*, 474–477.
4. HOWES, W. E. Duodenum; roentgenologically considered and including one case of primary carcinoma. *New York State J. Med.*, 1937, *37*, 1997–2005.
5. KIEFER, E. D., and MORAVEC, M. Diagnosis of carcinoma of pancreas. *S. Clin. North America*, 1943, *23*, 738–746
6. MATEER, J. G., and HARTMAN, F. W. Primary carcinoma of duodenum; clinical and pathologic aspects, with differential diagnosis. *J.A.M.A.*, 1932, *99*, 1853–1859.
7. POPPEL, M. H., and MARSHAK, R. H. Roentgen diagnosis of pancreatic disease. AM. J. ROENTGENOL. & RAD. THERAPY, 1944, *52*, 307–316.
8. RENDICH, R. A., POPPEL, M. H., and COVE, A. M. Roentgen diagnosis of space-occupying lesions in region of head of pancreas. *Radiology*, 1942, *38*, 47–52.

Vol. 66, No. 1

THE CLINICAL DIAGNOSIS OF ARTERIOSCLEROSIS IN THE AGED

WITH PARTICULAR REFERENCE TO INTERPRETATION OF ROENTGEN FINDINGS*

By FREDERIC D. ZEMAN, M.D., *and* MAX SCHENK, M.D.
NEW YORK, NEW YORK

THE rapidly increasing number of older people in our population has made it necessary for the physician to familiarize himself with the varied clinical manifestations of advanced vascular disease since he is now apt to be confronted by conditions formerly looked upon as rarities. The common tendency to ascribe all abnormalities in the aged to arteriosclerosis often leads to serious error. The diagnosis of "general arteriosclerosis" is still frequently seen on hospital records. This all inclusive designation should be dropped in order that the arteries or arterioles affected may be designated specifically such as, sclerosis (narrowing or occlusion) of cerebral arteries, retinal arterioles, coronary arteries, etc., where evidence is adequate to prove involvement. The word arteriosclerosis is used in this communication in its broadest sense since the arterial changes seen in the aged are the end result of varied processes whose nature is far from clear. Whether the lesions in our old patients are due to the aging process, to wear and tear, to infectious agents, to toxins, to allergens, or to nutritional and endocrine abnormalities, acting alone or all together, whether they affect the intima or the media or both, cannot surely be told in the light of our present day knowledge. The physician is faced with advanced pathological changes, endeavors to differentiate them from other conditions and attempts treatment, all the while seeeking through close study to separate definite clinical and etiologic forms from the large, roughly classified group.

The clinical diagnosis of arteriosclerosis depends upon the correlation of observed vascular changes and the associated functional variations. At times the disturbance of function may be so characteristic, as in angina pectoris or intermittent claudication, that the underlying pathological lesion may be inferred with a high degree of accuracy. Often the arteriosclerotic factor is only determined after thorough clinical and laboratory studies. In addition to the results of the patient's history and examination, roentgenograms often yield valuable information where dilatation, distortion or calcification of the vessels is present. Cerebral arteriography, angiocardiography and aortography are methods of great value in certain cases since variations in the size of the vascular lumina are brought out by the injection of contrast media. This communication will be limited, however, to discussion of direct roentgen examinations which not infrequently surprise the clinician by disclosing unsuspected lesions or unexpectedly wide involvement. Extensive calcific lesions of the heart and arteries as revealed in roentgenograms may exist under observation for many years before symptoms of disordered function appear since this type of arteriosclerosis is associated with dilatation rather than narrowing of the vascular lumina.

CASE 1. This man was admitted to the Home in 1932 at the age of seventy-four. At that time difficulty in determining his blood pressure was noted since no pulse could be obtained in the pipe-like radial artery. He enjoyed good health for nine years, but in 1941 he suffered an attack of myocardial infarction. After a period of six weeks' bed-rest he made an excellent functional recovery. At that time apparatus for diagnostic roentgenology had become available and his

* From the Medical Service, The Home for Aged and Infirm Hebrews, New York. Read before the American Society for the Study of Arteriosclerosis, November 1, 1948, Chicago, Illinois.

FIG. 1. Case 1. Upper extremities, showing brachial arteries tortuous, dilated, and calcified.

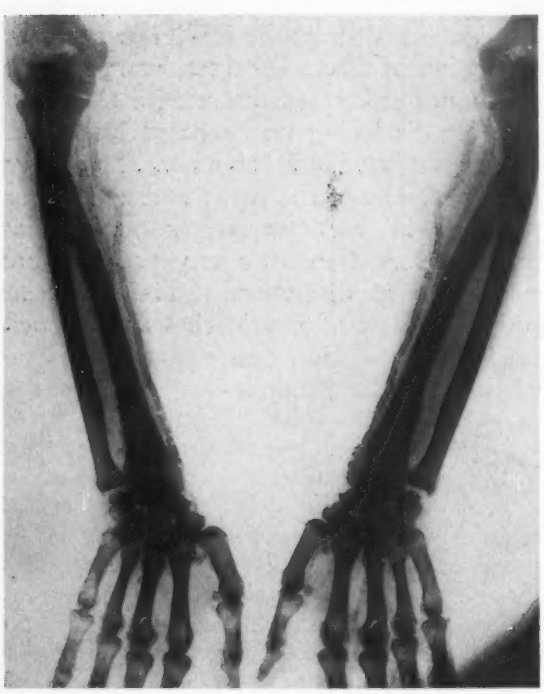


FIG. 2. Case 1. Forearms and hands, showing equal involvement of radial and ulnar arteries as well as of the interosseous vessels.

vascular tree was thoroughly studied. The heart was enlarged to the left, the aorta widened with calcific plaques in the arch. The abdominal aorta was clearly demonstrated as well as the common, external and internal iliac arteries. The major vessels of both arms and legs were generally tortuous and completely outlined by calcific deposits (Fig. 1, 2, 3 and 4). Even the interosseous vessels in the palms of the hands were clearly demonstrated. This condition had undoubtedly been present for many years. Blood cholesterol at that time (1941) was

FIG. 3. Case 1. Thighs, showing patchy involvement of femoral arteries and their branches.

136.6 mg. per cent, the esters 86 mg. per cent. The blood calcium was normal. In spite of the conversion of all the main vessels into actual pipes and notwithstanding his myocardial infarction, the functional capacity of this patient was noteworthy. He was a pleasant likeable individual who derived much pleasure from life. Two weeks prior to his death in 1943, he danced at a garden party without discomfort. The end came while sitting in the garden conversing with friends. Necropsy was not permitted.

Arteriosclerotic aneurysms of the abdominal aorta increase in frequency with

Fig. 4. Case I. Legs, showing diffuse calcification of tibial arteries.

age. Eliason and McNamee[8] reported 24 cases, of which 12 were arteriosclerotic, with ages from thirty-three to eighty-three years. Long[16] has recently reviewed 44 cases of arteriosclerotic iliac aneurysms from the Mayo Clinic. Of great clinical interest is the tendency of abdominal aneurysms to rupture into the retroperitoneal space,[4,5,17] into the rectum,[13] and into the duodenum.[12] Hunt and Weller[12] have described the symptom complex of abdominal aortic aneurysm rupturing into the gastrointestinal tract. Blakemore[2] and de Takats and Reynolds[7] have discussed the surgical therapy of these aneurysms.

Case II. This man is now seventy-seven years of age. In 1944 he underwent transurethral prostatectomy. On admission to the Home in September, 1946, a pulsating oblong mass was felt through the abdominal wall overlying the lumbar spine. The blood pressure was 140 mm. systolic, 70 mm. diastolic. Several toes on both feet showed well healed partial amputations which were said to have occurred spontaneously two years before. Roentgen examination of the chest disclosed the heart to be normal in size, with the aorta somewhat tortuous and elongated. A film of the abdomen showed an ovoid soft tissue mass overlying the lumbar vertebrae. The whole outline was fairly distinct, but was especially clear on the left side where it was visible as a thin line of calcific deposition (Fig. 5). This shadow coincided with the mass felt clinically and was

Fig. 5. Case II. Abdomen, with shadow cast by aneurysm of aorta indicated by arrows. On the left side, the thin line of calcium deposition is clearly shown.

interpreted as an aneurysmal dilatation of the abdominal aorta.

Repeated examinations over the past two years have shown no change in the size of the shadow. Of great interest is the recurrence of the patient's urinary symptoms which necessitated a second transurethral prostatectomy in March, 1948, under spinal anesthesia. This was well tolerated by the patient who is now clinically well and ambulatory.

The occurrence of bilateral gangrene of the toes with spontaneous amputations in this patient illustrates the caution that must be observed in attributing such changes entirely to peripheral vascular lesions. We know of one case where vascular disturbances in the legs over a period of twenty-five years were attributed to arteriosclerosis obliterans, but at postmortem complete thrombosis of the abdominal aorta was found in association with an amazingly rich collateral circulation. This type of slowly progressive aortic occlusion which is often on an arteriosclerotic basis is to be sharply differentiated from the type resulting in chronic cardiac patients from emboli lodging at the bifurcation of the aorta. Excellent studies of this gradual variety of aortic thrombosis have been made by Straus, Dominguez and Merliss,[20] by Gross and Philips,[9] and by Herrmann, Willis, McKinley and Karotkin.[10] Price and Wagner[18] have reported 2 cases diagnosed by direct translumbar aortography. Holden[11] has treated 2 patients successfully with bilateral retroperitoneal sympathectomy.

Roentgen examination of the heart and aorta is today a routine procedure to determine the size and shape of these two structures. Too often overlooked are opportunities for demonstrating calcifications of the valves and coronary arteries. Intracardiac calcifications are at times incidentally visualized on routine roentgenographic examinations. If the exposure is short enough and the roentgen film is accidentally overexposed, intracardiac calcifications have been seen on films taken with the Potter-Bucky diaphragm of the upper gastrointestinal tract and on oblique chest films taken with a small bedside unit when the heart action was slow. As a rule, however, roentgenoscopy is indispensable to identify intracardiac calcifications, to determine whether these calcifications are located in the coronary arteries, in the valve rings, in the cardiac chambers, ventricular muscle or pericardium, and to separate these from extracardiac calcific shadows by projection and by thorough study of their intrinsic movements. Roentgenoscopy requires full visual adaptation and a narrowed beam to see the minute dancing calcific bodies within the fairly dense heart shadow. Calcific valves are identified by their rotary motion which is independent of the movements of the cardiac contour. Coronary artery calcifications and those of the pericardium follow more closely the excursions of the heart muscle, and can usually be projected close to the cardiac contour by rotating the patient. Extracardiac calcifications, on the other hand, can be projected outside the actual heart shadow by rotation.

We have found it advantageous to use the spot film device for the demonstration of the intracardiac calcifications immediately following roentgenoscopic identification, using approximately 70 to 80 kv., 120 ma. and 1/20 second. The relatively small focal spot of the rotating anode tube, on the other hand, is desirable because this tube will give better definition and carry the load more easily than the conventional tube ordinarily attached to the combined roentgenoscopic and roentgenographic spot film unit.

In older people roentgenoscopic identification of the intracardiac calcifications becomes even more important because of the multiplicity of the extracardiac calcifications. In this age group, calcifications in ribs, costal cartilages, bronchi, pulmonary infarcts, and the like tend to confuse the roentgenographic picture. In addition, one will detect these intracardiac shadows roentgenoscopically much more often than one will demonstrate and identify them on the film provided one is properly adapted to the dark, a process which requires at least twenty minutes.

Aortic changes in the roentgenograms of the aged are so common in practice that they are considered of little significance, and yet they are of great clinical importance, as for example in making almost impossible a diagnosis of early syphilitic aortitis in an older individual. We have

recently studied 200 routine chest films to determine the variety of changes to be observed in the thoracic aorta of patients over sixty years of age. Of the entire series only 19 cases (9.5 per cent) appeared entirely normal. All the others showed elongation, widening and calcification in different combinations and varying in degree. The relation of these arteriosclerotic lesions in the aorta to the interpretation of blood pressure changes in the aged has been discussed by one of us elsewhere.[24] Dilatation of the aorta tends to reduce systolic pressure and, to a lesser degree, the diastolic pressure. These changes counterbalance the hypertensive effects of increased peripheral resistance or decreased aortic elasticity.

Calcified areas in the pericardium, myocardium and in the walls of cardiac aneurysms may at times be visualized. In 1934 Wosika and Sosman[23] reported the roentgen demonstration of calcified coronary arteries in 3 living subjects, 2 males aged sixty and sixty-seven years, 1 female, aged sixty-seven. The review of cardiac calcification by Bishop and Roesler[1] is valuable in stressing conditions under which metastatic calcification of the myocardium may occur.

Case III. This man, aged sixty-eight, was admitted to the Home two years ago. On routine roentgen examination of the heart a linear shadow was noted along the left border of the heart. On closer study this appeared to be the partially calcified left coronary artery (Fig. 6). The patient is up and about, with no cardiac complaints or evidence of heart failure. Eyeground examination shows sclerotic retinal vessels. Roentgen films of both upper and lower extremities disclosed calcific deposits in the arterial trunks. Pulsations were present in the dorsalis pedis and posterior tibial vessels.

The demonstration of calcific deposits in the aortic valves is an important diagnostic point in establishing the presence of aortic stenosis. Kumpe and Bean[15] found 5 such cases out of 11 studied roentgenoscopically and state that more systematic study would probably have yielded more positive findings. Considering that clinical diagnosis detects less than one-third of the cases found at postmortem, any method increasing diagnostic accuracy must be fully utilized.

Windholz and Grayson,[22] as well as Rytand and Lipsitch,[19] have emphasized the occurrence of calcified mitral annulus fibrosus in cases of heart block. The latter authors believe that heart block may be expected when the calcification spreads into the septum, particularly when excrescences reach out from the ring to invade the conduction system. Similar extensions into the septum may occur from calcified aortic valves or rings.

Fig. 6. Case III. Heart, with linear shadow along upper border interpreted as anterior descending branch of left coronary artery.

Case IV. This elderly female was admitted to this institution in 1938 at the age of seventy-two and died in 1946 at the age of eighty. The

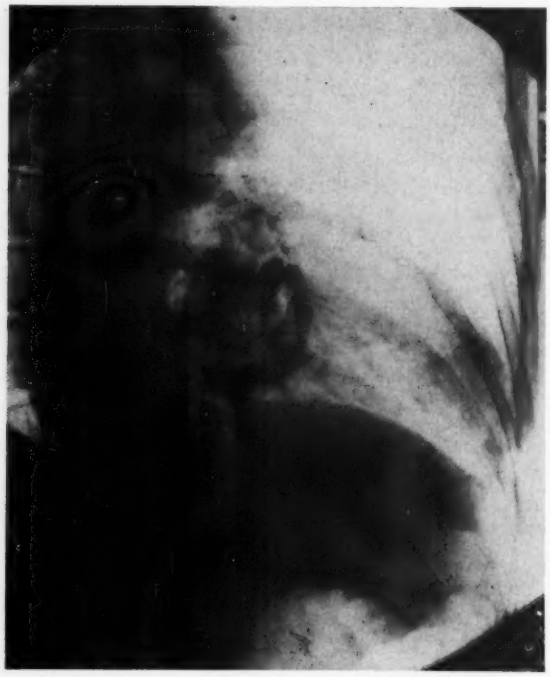


FIG. 7. Case IV. Heart, showing dense diffuse calcification of mitral annulus fibrosus.

following diagnoses were made: hypertension; arteriosclerotic heart disease; arteriosclerotic closures of vessels of both legs; amaurosis, left eye, due to glaucoma; status after operation—left eye—for glaucoma; varicose veins. On admission, the patient's blood pressure was noted to be 242/138. A loud systolic murmur was heard over the apex and at the base. It was decrescendo in character and remained constant throughout the years of observation. At times the patient showed gallop rhythm and on one occasion, while in congestive heart failure, a distant diastolic murmur was heard, which disappeared within a few hours after the patient's general condition improved. Roentgenograms showed diffuse calcification of the mitral annulus fibrosus (Fig. 7). The patient's systolic blood pressure never went below 200, even when she was in severe congestive failure. During one of the attacks of congestive failure, the patient died. Necropsy was not permitted.

This study of the roentgen findings in clinical arteriosclerosis would not be complete without mentioning the changes to be noted in the head. Camp[3] points out that "arteriosclerosis involving especially the internal carotid artery is evident in 1.8 per cent of all roentgenograms of the skull. The incidence varies naturally with age; it ranges from 4.2 per cent in the sixth decade to ten per cent in the eighth decade." Pressure on the optic nerves by sclerotic tortuous carotid arteries producing ocular symptoms as well as optic atrophy was described many years ago[21] and more recently by Knapp.[14] We have seen 2 such cases in the Home, one at postmortem examination, while the other was diagnosed clinically and confirmed by roentgen examination. Paralysis of the sixth cranial nerve may be caused by the sclerotic anterior inferior cerebellar artery. The increased incidence with age of trigeminal neuralgia suggests that arteriosclerotic vessels may be the causative agent. The deposition of calcium in the walls of intracranial aneurysms and their visualization by roentgenograms are strikingly illustrated in Dandy's work on intracranial aneurysms.[6]

CASE V. This man was admitted in April, 1945, at the age of seventy-five. The following diagnoses were made throughout the period of his observation: arteriosclerotic heart disease, Class 2B, coronary sclerosis, myocardial fibrosis; closure of peripheral vessels (legs) with intermittent claudication; sclerosis of retinal arteries; partial optic atrophy—left eye; senile

FIG. 8. Case V. Skull, showing parallel shadows of calcification traversing the sella turcica, interpreted as sclerotic left carotid artery.

degeneration of macula—both eyes; prostatic hypertrophy; status after treatment of squamous cell carcinoma of the tongue (Memorial Hospital, 1930). The patient was examined under paredrine dilatation in November, 1947. The right eye showed a pale disc. The arteries were narrowed, tortuous with dull light reflexes. The choroid showed through to a marked degree. The left eye showed a pale and atrophic disc, without cupping. The macular region had numerous old exudates. The tension in the right eye was 17, in the left eye, 28. The explanation of the peculiar field changes which were found again at this examination were not altogether clear. The possibility was suggested that pressure of a sclerotic carotid artery might cause the changes seen in the left eye. Roentgenographic studies of the skull were suggested. Roentgenograms showed a markedly calcific carotid artery shadow in close proximity to the sella turcica (Fig. 8).

SUMMARY

Local or diffuse calcific deposits in the cardiovascular system of older patients should not by themselves be considered the cause of functional changes. The cases cited illustrate how well certain types of arteriosclerotic lesions may be tolerated by the body and how little the functional capacity of an individual may be affected by them.

In a series of 200 chest films of individuals over sixty years of age, only 9.5 per cent (19 cases) showed no change in the heart and aorta. The relation of aortic lesions to the interpretation of blood pressure readings in older patients is again emphasized.

Roentgen studies of the heart in older patients aid materially in establishing the diagnosis of aortic stenosis, in clarifying the pathogenesis of heart block, and at times in visualizing the coronary arteries, myocardial infarctions, and cardiac aneurysms.

In the future, careful cardiovascular studies of aged individuals should include painstaking roentgenoscopy of the heart as well as roentgenograms of the head, the chest, the abdomen and the extremities to demonstrate calcification and other alterations of the major arterial trunks.

Frederic D. Zeman, M.D.
111 East 88th St.
New York 28, N. Y.

REFERENCES

1. Bishop, P. A., and Roesler, H. Roentgenologic diagnosis of intracardiac calcifications. Am. J. Roentgenol. & Rad. Therapy, 1934, *31*, 1–15.
2. Blakemore, A. H. Clinical behavior of arteriosclerotic aneurysm of abdominal aorta; rational surgical therapy. *Ann. Surg.*, 1947, *126*, 195–207.
3. Camp, J. D. Pathologic non-neoplastic intracranial calcification. *J.A.M.A.*, 1948, *137*, 1023–1031.
4. Case Records, Mass. Gen. Hosp., Case No. 30512. *New England J. Med.*, 1944, *231*, 853–856.
5. Case Records, Mass. Gen. Hosp., Case No. 33502. *New England J. Med.*, 1947, *237*, 921–924.
6. Dandy, W. Intracranial Arterial Aneurysms. Charles C Thomas, Publisher, Springfield, Ill.
7. de Takats, G., and Reynolds, J. T. Surgical treatment of aneurysms of abdominal aorta. *Surgery*, 1947, *21*, 443–454.
8. Eliason, E. L., and McNamee, H. G. Abdominal aneurysm. *Am. J. Surg.*, 1942, *56*, 590–593.
9. Gross, H., and Philips, B. Complete occlusion of abdominal aorta. *Am. J. M. Sc.*, 1940, *200*, 203–208.
10. Herrmann, G. R., Willis, J. G., McKinley, W. F., and Karotkin, L. Embolism and secondary thrombosis of bifurcation of aorta. *Am. Heart J.*, 1943, *26*, 180–199.
11. Holden, W. D. Arteriosclerosis obliterans of abdominal aorta. *Arch. Surg.*, 1946, *53*, 456–461.
12. Hunt, H. H., and Weller, C. V. Syndrome of abdominal aortic aneurysm rupturing into gastrointestinal tract. *Am. Heart J.*, 1946, *32*, 571–578.
13. Jackman, R. J., McQuarrie, H. B., and Edwards, J. E. Fatal rectal hemorrhage caused by aneurysm of internal iliac artery. *Proc. Staff Meet., Mayo Clin.*, 1948, *23*, 305–308.
14. Knapp, A. Association of sclerosis of cerebral basal vessels with optic atrophy and cupping. *Arch. Ophth.*, 1932, *8*, 637–648.
15. Kumpe, C. W., and Bean, W. B. Aortic stenosis. *Medicine*, 1948, *27*, 139–185.
16. Long, M. C. Aneurysms of iliac arteries. *J. Gerontol.*, 1948, *3*, 105–110.

17. NAMMACK, G. D., and HIRSCH, S. External sign in retroperitoneal rupture of abdominal aorta. *New York State J. Med.*, 1945, *45*, 1232–1233.
18. PRICE, A. H., and WAGNER, F. B., JR. Complete occlusion of abdominal aorta. *Surg., Gynec. & Obst.*, 1947, *84*, 619–624.
19. RYTAND, D. A., and LIPSITCH, L. S. Clinical aspects of calcification of mitral annulus fibrosus. *Arch. Int. Med.*, 1946, *78*, 544–564.
20. STRAUS, R., DOMINGUEZ, R., and MERLISS, R. Slowly progressive occlusive thrombosis of abdominal portion of aorta. *Am. J. M. Sc.*, 1946, *211*, 421–427.
21. WILSON, S. A. K. Neurology. Edited by A. N. Bruce, William Wood & Company, Baltimore, 1940, Vol. II, p. 1106.
22. WINDHOLZ, F., and GRAYSON, C. Roentgen demonstration of calcifications in interventricular septum in cases of heart block. AM. J. ROENTGENOL. & RAD. THERAPY, 1947, *58*, 411–421.
23. WOSIKA, P. H., and SOSMAN, M. C. Roentgen demonstration of calcified coronary arteries in living subjects. *J.A.M.A.*, 1934, *102*, 591–593.
24. ZEMAN, F. D., and SCHWARTZ, B. M. Effect of arteriosclerosis on dynamics of hypertension in aged. *J. Gerontol.*, 1948, *3*, 40–47.

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EXTRAMUCOSAL INTRAMURAL ENTERIC CYST OF THE ESOPHAGUS

A CASE REPORT

By BERNARD D. ROSENAK, M.D., F.A.C.P., *and* HELEN D. VAN VACTOR, M.D.
INDIANAPOLIS, INDIANA

CASE REPORT

The patient, a male, aged fifty-three, was seen at home on the night of October 8, 1947, because of dull pain located in the lower substernal region and epigastrium. The pain was moderate in degree and of brief duration. It did not radiate in any direction and was not accompanied by nausea, vomiting, diarrhea or fever. No similar attacks had occurred before; but about three weeks prior he had noticed some dysphagia, consisting of a sense of fullness in the lower chest on swallowing, which lasted for one or two days. On the following morning, an electrocardiogram, blood cell count, and urine analysis were normal, and he was advised to return for further study.

The past history revealed a tendency to frequent upper respiratory infections. He had sustained an injury to his left knee and was planning to undergo surgery for the correction of this difficulty. There was no history of dyspnea, orthopnea, cough, anorexia, or weight loss. The patient's mother had had cancer of the stomach, but the remaining family history was negative.

Physical examination showed a well developed thin man, aged fifty-three, weighing 145 pounds. The head and neck were normal. The heart was not enlarged and no murmurs were heard. The pulse was 72 and the blood pressure was 115/70. Examination of the lungs was negative, signs of mediastinal obstruction were absent, and no abnormal lymphadenopathy was found. Abdominal examination was negative. The prostate was moderately enlarged and soft. There was limitation of motion of the left knee.

The hemoglobin was 14 gm., the red blood cell count 4,970,000, and the white blood cell count 5,300, with a normal differential. Sedimentation rate was 9 mm. in one hour. Urine analysis was negative.

Roentgen examination of the chest in the anteroposterior view showed a normal heart shadow, calcified hilar glands, and normal lung fields. Oblique views demonstrated a well defined, rounded mass located posteriorly in the lower mediastinum at the level of the seventh and eighth dorsal vertebrae (Fig. 1). On October 13, roentgenoscopy of the esophagus, after the ingestion of barium, showed evidence of marked compression of its lower half. Roentgenograms showed a lesion compressing the esophagus anteroposteriorly, which arose from

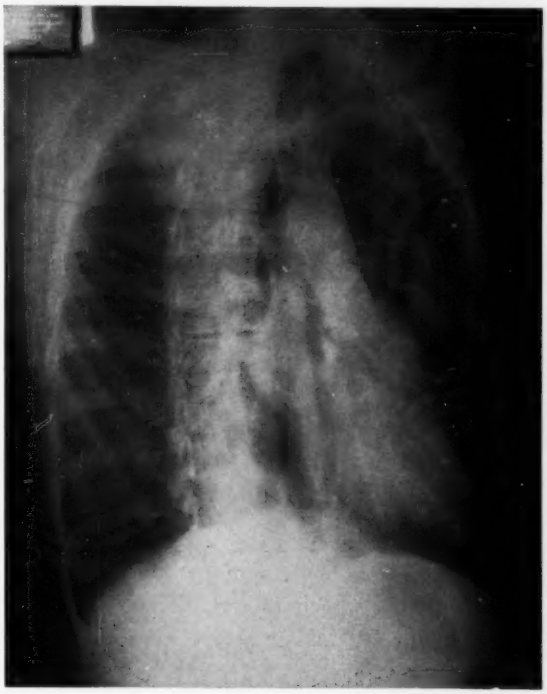

FIG. 1. Right anterior oblique view of the chest shows the tumor mass protruding into the posterior mediastinal space.

a point about 3 cm. below the aortic indentation and extended inferiorly for a distance of about 7 cm. As seen in the anteroposterior view, it produced a widening of the esophagus with thinning of the column of barium and obliteration of the mucosal pattern so as to produce a smudged appearance. In the right anterior oblique position, the superior and inferior margins of the lesion were rather sharply angulated, suggesting an intramural or extrinsic

FIG. 2. Anteroposterior view of barium-filled esophagus showing widening and anteroposterior thinning of involved segment of esophagus with obliteration of mucosal pattern.

lesion rather than an infiltrative mucosal tumor (Fig. 2 and 3). The stomach and duodenum were normal. Esophagoscopy was done three days later and the walls of the lower third of the esophagus were found to be compressed anteroposteriorly, narrowing the lumen considerably. There was an area of mild esophagitis present at the site of compression, but no other mucosal lesion was seen.

Our impression was that this patient had a mediastinal tumor which involved the esophagus, but we were unable to determine definitely whether it was primarily of intramural or extrinsic origin. He was determined to carry out previous plans for orthopedic surgical treatment of his knee. On November 11 he entered the Methodist Hospital in Indianapolis and the left patella was removed. Because of the possibility that the mediastinal tumor might be of the lymphoma group, he was given roentgen therapy over the mediastinum while he was in the hospital. A total of 650 r anteriorly and 400 r posteriorly, with 2 mm. copper and 1 mm. aluminum filters, was administered. On November 17 the hemoglobin was 12 gm., the red blood cell count 3,770,000, and the white blood cell count 6,300 with 89 per cent polymorphonuclears, 8 per cent lymphocytes, and 3 per cent eosinophils.

The patient failed to return for follow-up study until January 9, 1948, when it was

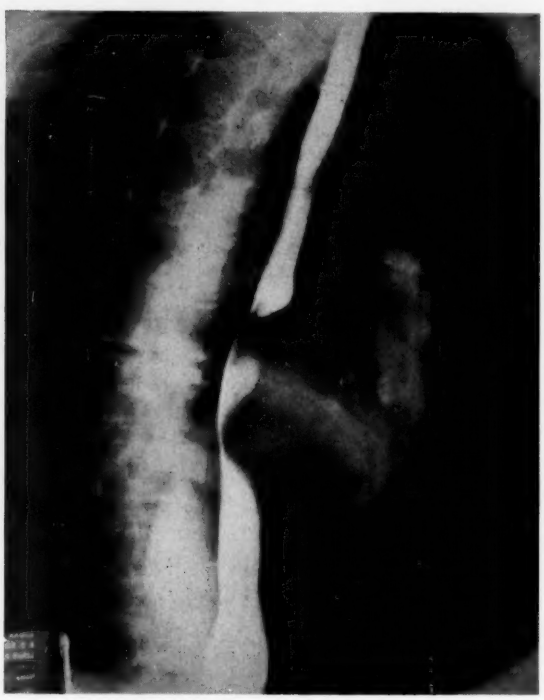

FIG. 3. Right anterior oblique view of the barium-filled esophagus, demonstrating compression anteroposteriorly with angulation of the barium column at junction of tumor and normal mucosa suggestive of an extramucosal lesion. Evidence may be seen of mucosal striation on posterior wall.

thought that there was some decrease in size of the tumor seen on the roentgenogram. There had been a weight loss of 9 pounds, and he stated that he had noticed mild, intermittent substernal discomfort which was partially relieved by a soft diet. We believed that surgical exploration of the mediastinum was indicated and he was admitted to the Mayo Clinic on January 26, 1948.

It was agreed that surgery was advisable and Dr. Stuart Harrington performed the operation on February 9. Following is the surgical report:

"A right posterolateral incision was made with resection of the posterior two-thirds of the seventh rib and the removal of 2 cm. from the angles of the sixth and eighth ribs. Upon exposing the lung, there appeared to be a number of hyalinized scars on the visceral surface of the upper lobe of the right lung. The lung was very grayish-black in color from carbon deposits. When the esophagus was exposed, a large cyst was found in the wall of the esophagus at about the level of the seventh and eighth vertebrae

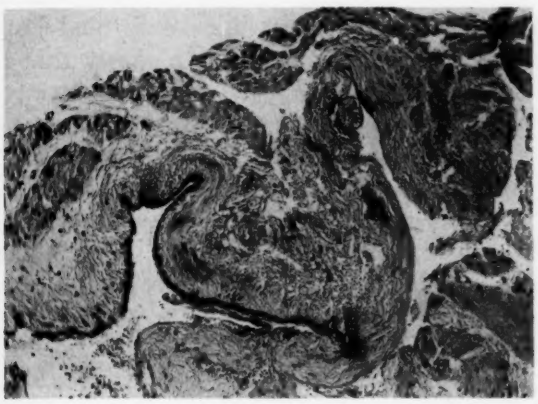

Fig. 4. Section of tissue from cyst wall showing cross section of locule lined with cuboidal epithelium and surrounded by bundles of smooth muscle fibers.

on the same level as the hilus of the right lung, as it was only 3 cm. below the azygos vein. The mediastinal pleura overlying the cyst was incised, and the cyst was completely excised from the wall of the esophagus. It was about 5 cm. in diameter and contained about one and one-half ounces of thick, dark mucoid material with some old blood. The lining was very adherent to the surrounding wall of the esophagus, as an indication that there had been some inflammatory process in the wall of the cyst, and there undoubtedly had been some hemorrhage into the cyst. There was no true communication with the lumen of the esophagus, and the mucous membrane of the esophagus was not opened during the operation. After removing the lining of the cyst, the wall of the esophagus was reconstructed with interrupted catgut sutures, as well as interrupted silk sutures, making a very satisfastory closure of the wall. The operation was difficult because of the fixation of the mucous membrane of the wall of the cyst. The chest wall was closed in layers after 350,000 units of penicillin were instilled."[7] The pathological report stated that section of the tissue removed from the esophagus revealed an enteric cyst lined with ciliated columnar epithelium with evidence of old hemorrhage in the lumen. Smooth muscle was present in the cyst wall[7] (Fig. 4). The postoperative course was good, and the patient was dismissed on March 2, 1948. Three weeks later he reported to us, at which time he weighed 136 pounds and had no complaints. On May 4 he had regained his previous weight of 145 pounds and was asymptomatic. Roentgenograms showed some puckering in the posterior mediastinum and a normal esophagus (Fig. 5).

This case is representative of a rare condition, enteric cyst of the esophagus, one of a small group of benign tumors of this organ. In a review of the literature Moersch and Harrington,[9] quoting Patterson, found only 62 reported cases of benign esophageal tumors (including necropsy study) from 1717 to 1932. These authors reported 15 additional cases. They quoted Vinson *et al.*, who in 1926 reviewed 4,000 cases seen for dysphagia at the Mayo

Fig. 5. Postoperative view of barium-filled esophagus showing relatively normal esophagus and puckered area in posterior mediastinum at site of cyst.

Clinic and found only 3 benign tumors, and have added 12 more from a study of an additional 7,000 similar cases from 1926 to 1944. Realizing that a study limited to dysphagic patients might lead to an erroneous idea of incidence, 7,459 autopsies at the Mayo Clinic were reviewed and 44 benign tumors of the esophagus, all asymptomatic, were revealed.[9] Leiomyomas are the most common of the benign tumors, while cysts are rare; Moersch and Harrington have found only two cysts in their group of 15 cases. Adams and Hoover,[1] in a similar review, listed only six cysts of the esophagus reported from 1712 to 1943.

Cysts of enteric origin can and do occur any place along the gastrointestinal tract, and in the mediastinum they are referred to as esophageal duplications.[5] They may or may not be attached to the esophagus, and the lining consists of gastric or intestinal mucosa, or both. Mediastinal enteric cysts and those of the esophagus, i.e., attached to it, are related; yet the latter form a definite entity. The former are more commonly gastric rather than enteric.[5] They are more often found in infants and usually occur in the posterior mediastinum on the right side; however, they may arise in the middle or on the left.[3,10,13] Occasionally extension through the diaphragm occurs.[12] Esophageal enteric cysts are encountered more often in adults and are commonly located in the lower half of the esophagus. The lining may be of ciliated cuboidal or columnar epithelium with areas of flattened cells. The muscular wall consists of one or two layers and may be fused with that of the esophagus, or it may be shared in common with cyst and esophagus. There is no serosa. Cysts may arise from a short pedicle connected with the esophageal wall.[6]

There are several theories as to the origin of enteric cysts. It has been suggested that they may result from a pinching off of an out-bud from the foregut at the time of development of the lung buds in the 14 mm. embryo.[2,8,10] Other possibilities have been cited, namely that the duplications are due to an intrathoracic remnant of the omphalomesenteric duct or to an embryonic diverticulum (an epithelial remnant) capable of producing intestinal or gastric mucosa.[2,10] Olken[10] suggests a possible combination of these theories. The embryology of esophageal duplication is described by Ladd and Scott[5] as "analogous to atresia in that there is a failure of coalescence of vacuoles in the solid stage of the alimentary tube in its longitudinal axis so that continuity of the lumen is not established aborally," and they quote Keith's view that it results from a failure of coalescence of these vacuoles transversely so that cystic structures are left contiguous to some portion of the gastrointestinal tract. Quoting Bremer, these authors[5] state that various forms of attachments of duplications can be explained by the distance of the sequestrated vacuoles from the true lumen of the primitive alimentary tract. According to Dickson, Clagett and McDonald,[3] the greater the distance of the vacuoles from the lumen, the more likely that there will be no attachment between the cyst and the alimentary tract.

Benign esophageal tumors may be classified into two types, mucosal and extramucosal, according to their location. In the latter group, of which this case is an example, symptoms are very frequently absent. When present, they usually do not occur until adulthood and are typically mild. Substernal discomfort is probably the most common complaint, but dysphagia, weight loss, cough and dyspnea may occur. Rarely do such tumors cause any marked obstruction unless they attain great size. An abnormal mediastinal shadow on the roentgenogram may be the only sign of pathology in the absence of definite symptoms. Filling of the esophagus with barium is then necessary to demonstrate any relationship to this organ. Actually the type of extramucosal tumor cannot be established preoperatively, although the most common one is leiomyoma. Particularly one cannot be sure whether the mass is solid or cystic, for the only clue to the diagnosis of the

latter type is the inconstant presence of a fluid level or a change in shape of the mass on respiration or with peristalsis.[11] It is extremely important that the diagnosis be made, for the prognosis which can be given for benign esophageal tumors is usually favorable.

Roentgenography of the esophagus after ingestion of barium is a valuable means of differentiating extramucosal intramural tumors from infiltrating tumors involving the mucosa and mediastinal tumors extrinsic to the esophagus. The first consideration is to determine, if possible, whether the tumor is one arising in the esophagus or outside it. In 1942 Schatzki and Hawes[11] performed an interesting study concerning the diagnosis of extramucosal tumors by roentgenography. A common feature of their 6 cases was the presence, in profile view, of an abrupt, sharp angle where the edge of the tumor met the normal wall of the esophagus. It was noted that the mucosa overlying the tumor is usually stretched out and a mucosal relief picture not obtained. However, the folds of the opposite wall can be demonstrated in many instances. If the mass is large, the lumen may be slit-like, due to the fact that the organ is narrowed in one diameter, yet widened in the opposite direction. Therefore these authors point out that in a face-on view of this flat lumen, the barium may be irregularly distributed over the smooth surface of the tumor with a "smearing" effect so that its appearance is easily mistaken for an ulcerated area. Distinguishing features may be missed without careful study on profile and face-on view with adequate filling (not over-filling) with barium. Extramucosal tumors usually show a soft tissue mass extrinsic to the barium-filled esophagus.

Esophagoscopy, although of no value in differentiating extramucosal intramural lesions from extra-esophageal ones, should be done in an attempt to determine whether there is infiltration of the mucosa. Frequently the overlying mucous membrane is normal in extramucosal tumors; yet in some cases, as in this one, esophagitis may be present in the involved area.

The treatment of extramucosal tumors of the esophagus is surgical. Although indications for removal of benign tumors are less urgent than those for malignant tumors, the possibility of malignant changes occurring is one which does not allow indefinite delay.[4] With all diagnostic procedures, including the above roentgenologic criteria, one cannot always be sure of the exact nature of the tumor, and exploration is necessary. Extramucosal tumors are not easily accessible, and the extent of the surgical procedure varies with the site, size and degree of esophageal involvement. The exact type of site of origin of this tumor was not certain prior to surgery, although it was thought to be an extramucosal intramural lesion. The operation placed the diagnosis in the benign group with a good prognosis and demonstrated an interesting, uncommon entity.

SUMMARY

1. A case of enteric cyst of the esophagus treated surgically is reported.

2. This condition is a rare component of the small group of benign esophageal tumors.

3. Embryology of esophageal duplications is reviewed.

4. Diagnosis and treatment of extramucosal tumors are discussed.

226 Hume-Mansur Bldg.
Indianapolis 4, Indiana

REFERENCES

1. Adams, R., and Hoover, W. B. Benign tumors of esophagus. *J. Thoracic Surg.*, 1945, *14*, 279–286.
2. Carlson, H. A. Congenital cysts of mediastinum. *J. Thoracic Surg.*, 1943, *12*, 376–393.
3. Dickson, J. A., Clagett, O. T., and McDonald, J. R. Intrathoracic gastric cyst. *J. Thoracic Surg.*, 1946, *15*, 318–323.
4. Harrington, S. W., and Moersch, H. J. Surgical treatment and clinical manifestations of benign tumors of esophagus with report of 7 cases. *J. Thoracic Surg.*, 1944, *13*, 394–414.
5. Ladd, W. E., and Scott, H. W., Jr. Esophageal duplications or mediastinal cysts of enteric origin. *Surgery*, 1944, *16*, 815–835.

6. Mass. Gen. Hosp. Case 31351. Congenital mediastinal cyst arising from esophagus. *New England J. Med.*, 1945, *233*, 278–281.
7. Mayo Clinic. Personal communication.
8. Mixter, C. G., and Clifford, S. H. Congenital mediastinal cysts of gastrogenic and bronchogenic origin. *Ann. Surg.*, 1929, *90*, 714–729.
9. Moersch, H. J., and Harrington, S. W. Benign tumor of esophagus. *Ann. Otol., Rhin. & Laryng.*, 1944, *53*, 800–817.
10. Olken, H. G. Congenital gastro-enteric cysts of mediastinum. *Am. J. Path.*, 1944, *20*, 997–1009.
11. Schatzki, R., and Hawes, L. E. Roentgenological appearance of extramucosal tumors of esophagus. Am. J. Roentgenol. & Rad. Therapy, 1942, *48*, 1–15.
12. Valle, A. R., and White, M. L., Jr. Thoracic gastric cyst. *Ann. Surg.*, 1946, *123*, 377–383.
13. Wyllie, W. G., and Pilcher, R. S. Intrathoracic cysts of intestinal and bronchial structure. *Arch. Dis. Childhood*, 1943, *18*, 34–40.

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GASTRODUODENAL INTUSSUSCEPTION*

By RICHARD H. MARSHAK, M.A., M.D., JOAN LIFSAY, M.D.,
and SIGMUND BRAHMS, M.D.

NEW YORK, NEW YORK

INTUSSUSCEPTION of the stomach into the duodenum is a rare condition which is seldom diagnosed roentgenologically. It usually occurs in the presence of a pedunculated tumor when, as a result of peristaltic activity, the tumor is propelled distally and drags with it a portion of the stomach. Unlike intussusception in other parts of the gastrointestinal tract, most of the reported cases occur in adults.

One of the earliest reports (1898) of this condition by Chiari[2] is that of a forty-three year old female in whom the invagination was produced by a large adenoma of the stomach. Eusterman and Senty[6] in 1922 describe a patient of sixty-five in whom there was a fibromyoma 5 cm. in diameter on the posterior wall of the stomach, 7.5 cm. above the pylorus. The tumor, dragging with it the wall of the stomach, invaginated through the pylorus into the duodenum, a distance of 12.5 cm. forming an intussusception of a portion of the stomach into the duodenum.

Matas[8] in 1923 cites the case of a man of fifty-five in whom gastric intussusception was due to a polypoid fibroadenoma of the stomach. His operative note reads as follows: "While attempting to exteriorize the pylorus for further inspection, the manipulations dislodged the mass en bloc, and to our surprise this retreated completely into the stomach leaving the pyloric ring free and without the slightest evidence of infiltration or thickening." The roentgenograms in this case were interpreted as a malignant tumor of the pyloric end of the stomach.

In both of the above cases and in cases reported by Bogoras[1] and Saupe[12] roentgenograms were made but there was no exact preoperative diagnosis.

In 1933 Lönnerblad[7] described 2 cases of gastric invagination into the duodenum in which the exact diagnosis was made roentgenologically. According to the author, the diagnosis was made on the following criteria: "straightening of the lesser curvature, shortening of the canal, retention, increased width of the duodenum due to an invaginated tumor; and further, in one of the cases a central, tunnel-shaped deficiency of filling with axial streaks of contrast substance surrounded by rings of the same; in the other case, an oblique, ribbon-like filling defect from the side of the lesser curvature of the stomach toward the pylorus." On repeated examination a few days later, the invagination was found to have receded spontaneously.

As far as Lönnerblad is aware, prior to 1933 there was no case published in which the diagnosis of an invagination of the stomach into the duodenum has been established roentgenologically.

Other instances of invagination of the stomach have been reported but no mention of a roentgen examination is recorded. One of the most interesting is a report by Mouat[9] where a distended duodenum perforated and, at operation, a large mass was found in the duodenum which was felt to slip back into the stomach.

The case to be presented is that of a seventy-three year old male whose roentgenograms revealed a lesion of the second portion of the duodenum which, at operation, proved to be a gastroduodenal intussusception secondary to pedunculated adenomas of the stomach.

CASE REPORT

E. A., a white male, aged seventy-three, was admitted to Mount Sinai Hospital because of black stools of two months' duration, increasing weakness, weight loss and marked anemia. Barium enema examination made elsewhere was negative. A gastrointestinal series performed a few days later revealed a polypoid

* From the Department of Roentgenology, Mount Sinai Hospital, New York, New York.

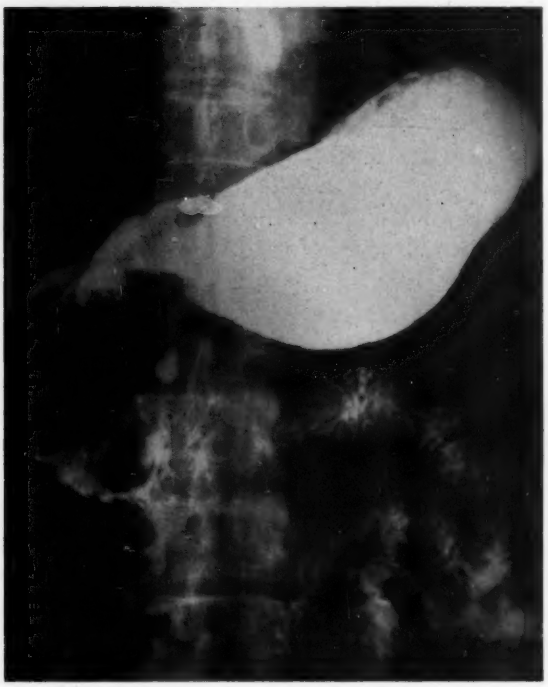


FIG. 1. There is a large mass noted in the second portion of the duodenum. The pyloric canal is obliterated. A ribbon-like defect extends from the side of the lesser curvature of the stomach toward the pylorus. There is straightening of the lesser curvature aspect of the stomach. The findings are due to a gastroduodenal intussusception.

lesion of the second portion of the duodenum.

Physical examination revealed a fairly well developed, markedly anemic male. Blood pressure 170/70. There was a soft systolic murmur at the apex. Abdominal examination was negative. The electrocardiogram was normal. Chlorides 455 mg. per cent. The stools were shown to contain blood. Hemoglobin was 22 per cent. Four transfusions were administered, at the end of which time the hemoglobin was 50 per cent.

Roentgen examination of the gastrointestinal tract revealed a mass, 4.5 by 4.0 cm., in the second portion of the duodenum (Fig. 1 and 2). The mucosa in this region was distorted and compressed. The pyloric canal was obliterated and there was a ribbon-like defect extending from the side of the lesser curvature of the antrum of the stomach toward the duodenum. The duodenal bulb was never satisfactorily visualized. At the end of four hours none of the barium remained within the stomach. The roentgenograms suggested a tumor of the second portion of the duodenum.

Operative Note. On opening the abdomen there was no free fluid. The liver was normal in size. In the first portion of the duodenum a firm, round mass was palpated. During palpation the mass accidentally slipped through the operator's fingers and reduced itself into the stomach from where it originated. A subtotal gastric resection was performed.

Upon opening the stomach (Fig. 3) an adenoma the size of a quarter was seen attached by a broad base to the greater curvature of the

FIG. 2. Again, illustrating the widening of the second portion of the duodenum. The ribbon-like defect is not seen on this roentgenogram.

stomach in the region of the antrum. A slightly smaller adenoma was seen situated immediately adjacent to this larger one.

Pathological Diagnosis. Two benign, pedunculated adenomas of the stomach.

Comment. After operation the cause of the ribbon-like defect (Fig. 1) extending from the lesser curvature side of the stomach toward the pylorus became more apparent as it was probably due to the

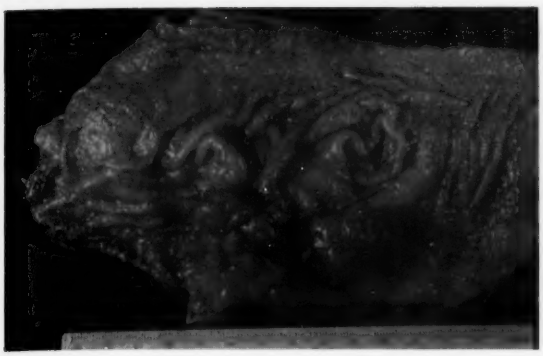


Fig. 3. Operative specimen illustrating two adenomas attached to the greater curvature of the stomach in the region of the antrum. Pathological diagnosis: Benign pedunculated adenomas.

space between the stomach and the duodenum. The adenomas had prolapsed into the duodenum dragging with it a portion of the posterior wall of the stomach resulting in a gastroduodenal intussusception. The pedicles were broad and far too small to account in themselves for the findings described above. These roentgenograms were essentially the same as those reported by Lönnerblad[7] in 1933.

CONCLUSION

(1) A case of gastroduodenal intussusception is presented.

(2) A review of the roentgenograms revealed the typical findings present in such lesions.

Richard H. Marshak, M.D.
1075 Park Ave.
New York 28, N. Y.

REFERENCES

1. Bogoras, N. Über die gastro-duodenale Invagination durch Magensarkom. *Zentralbl. f. Chir.*, 1930, *57*, 2291–2295.
2. Chiari, A. *Prag. med. Wchnschr.*, 1888, *13*, 221.
3. Collier, W. Multiple polypi of stomach and intestine. *Tr. Path. Soc. Lond.*, 1896, *47*, 46.
4. Doebler, E. Ueber Invaginatio gastro-duodenalis. Bresl. Genossenschafts-Buchdr., Breslau, 1918.
5. Eliasson, E. L., and Wright, V. W. M. Benign tumors of stomach. *Surg., Gynec. & Obst.*, 1925, *41*, 461–472.
6. Eusterman, G. B., and Senty, E. G. Benign tumors of stomach. *Surg., Gynec. & Obst.*, 1922, *34*, 5–15.
7. Lönnerblad, L. Zwei Fälle von Mageninvagination. *Acta radiol.*, 1933, *14*, 82–94.
8. Matas, R. Pediculated polypoid fibro-adenoma of stomach of ball-valve type, causing unusual and complex syndrome. *Surg., Gynec. & Obst.*, 1923, *37*, 723–731.
9. Mouat, T. B., Polypus of stomach. *Brit. J. Surg.*, 1925, *13*, 165–168.
10. Nothnagel, A. Die Erkrankungen des Darms und des Peritoneum. *Spec. Path. u. Therap.*, 1898, 17.
11. Poppel, M. H., and Herstone, S. T. Intussusception of stomach. Am. J. Roentgenol. & Rad. Therapy, 1945, *53*, 585–586.
12. Saupe, E. Die Invagination von Magenpolypen in das Duodenum. *Röentgenpraxis*, (Hft. 16), 1932, *4*, 694–698.
13. Schmieden, V., and Westhues, H. Ueber Invaginationen am Magen. *Deutsche Ztschr. f. Chir.*, 1927, *200*, 251–272.
14. Shuman, J. W., and Cruikshank, D. Duodenal intestinal obstruction, secondary to gastric polyp and intussusception due to multiple teniae saginatae. *New York M. J.*, 1923, *117*, 694–695.
15. Wade, H. Intussusception of stomach and duodenum due to gastric polypus. *Surg., Gynec. & Obst.*, 1913, *17*, 184–190.

MASSIVE UMBILICAL HERNIA*

By ALEXANDER LEWITAN, M.D., *and* WALTER SLADE, M.D.
BROOKLYN, NEW YORK

THE purpose of this report is to record an unusual case of a massive umbilical hernia in a diabetic female, aged fifty-four, containing the stomach, entire small intestine and large intestine, with the exception of the rectum.

A review of the literature for the past twenty-five years shows isolated instances in which the hernia contained the stomach, liver, colon, or small intestine, but no case contained more than a portion of these structures.

A fifty-four year old female was admitted on April 7, 1949, to the Jewish Sanitarium with a diagnosis of diabetes mellitus and umbilical hernia. The patient married at the age of twenty years and was a gravida VII. Shortly after her marriage, she fell, injuring the umbilical area. This injury was complicated by an infection. The patient states that a few days later the umbilical hernia appeared. Surgery was advised but the patient refused an operation. No marked progress in the size of the hernia was noted until eighteen years later. About this time the patient gave birth to a 5 pound, 4 ounce girl. An internal podalic version was done. It is from this date that the patient dates the onset of the progressive increase in the size of the hernia. A year later she lost weight, had cold sweats, polyuria, polyphagia, and finally lapsed into coma. A diagnosis of diabetes mellitus was made for which she received treatment.

FIG. 1. A photograph of the umbilical hernia. Numerous scars are noted due to the previous ulcerations of the skin of the hernial sac.

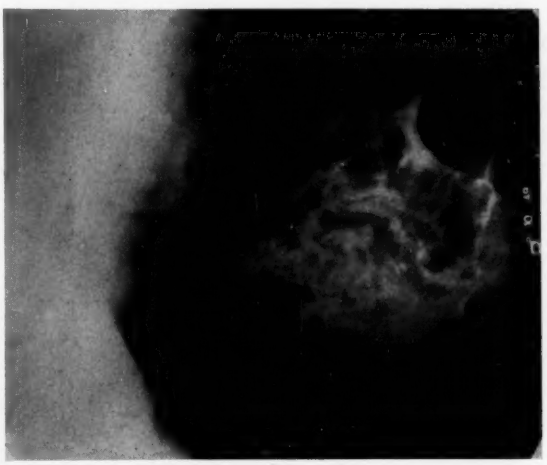


FIG. 2. Flat film of the abdomen. Lateral view of the umbilical hernia. The tremendous size of the hernial sac is demonstrated. The colon occupies the superior part of the hernia. Marked calcification within the mesenteric vessels and elongation is noted.

On April 5, 1948, the patient was admitted to a local hospital because of non-healing ulcerations of the skin over the umbilical hernia.

Physical examination revealed on admission a female, weighing 103 pounds, of short stature. The blood pressure was 155/120. A massive umbilical hernia was present which reached just above the knees. The patient was non-ambulatory, but was able to sit up in a wheel chair. There were many healed scars over the skin of the hernia. Visible peristalsis of the large and small intestines was noted in the hernia. The lungs were clear to percussion

* From the Radiological Service of The Jewish Sanitarium and Hospital for Chronic Diseases (Dr. L. Nathanson, Director), Brooklyn, New York.

and auscultation. The heart rate was 72 and the rhythm regular. A systolic murmur was heard at the base. There was evidence of marked arteriosclerosis, and the peripheral arteries were palpable and showed beading. The hernia was irreducible. The liver and spleen could not be palpated.

Laboratory data disclosed the following: Wassermann reaction was negative. The blood count showed a moderate anemia. The blood chemistry showed a sugar varying from 373–278. Urea nitrogen was 20. Total cholesterol, 370. Ester cholesterol, 250.

Urine analysis showed a 1 plus albumin, 4 plus sugar, acetone negative, specific gravity, 1.030.

Roentgen examinations were carried out. A flat film of the abdomen showed the small and large intestine apparently within the hernial sac. There was marked calcification within the mesenteric vessels. Examination of the gastrointestinal tract showed no evidence of intrinsic pathology within the esophagus. The abdominal segment of the esophagus was markedly elongated and was seen at the entrance of the large hernial sac. The stomach appeared to be completely rotated. The entire stomach, the duodenal bulb, the second and third portions of the duodenum were within the umbilical hernia. Within the body of the stomach large ballotable bodies could be visualized, which were identified as retained food. The hernial sac contained all the identifiable structures of the small intestine, entire colon, with the exception of the rectum. In view of the presence of the second and third portions of the duodenum within the hernia, the pancreas was, in all probability, within the hernia. A marked degree of calcification of the abdominal aorta, mesenteric vessels, and calcification of the entire arterial system within the extremities, was demonstrated on all roentgenograms of the extremities.

Fig. 3. The entire stomach is demonstrated within the hernia. The marked elongation of the abdominal segment of the esophagus is seen in close proximity to the hernial orifice. The duodenal bulb is seen above the stomach. The second and third portions of the duodenum and duodenal bulb are seen within the hernial contents.

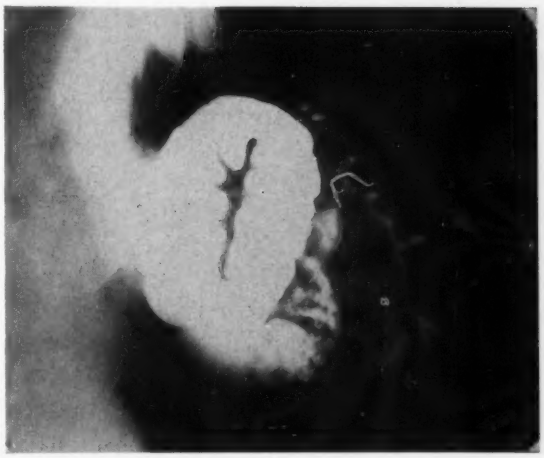


Fig. 4. The barium enema showing the sigmoid and colon completely within the hernial sac.

Examination of the gallbladder showed nonvisualization.

Examination of the genitourinary tract showed the kidneys to be low in position. The left kidney appeared in a relatively anterior position which suggested possible inclusion within the hernia. The bladder appeared to be in its normal position.

DISCUSSION

This case of massive umbilical hernia, though typical in its long duration, is atypical in its contents: stomach, duodenum, pancreas, jejunum, ileum, cecum, ascending colon, transverse colon, descending colon, and sigmoid colon, and possibly in the inclusion of a retroperitoneal organ; the left kidney. Though many complications are possible, massive umbilical hernia is compatible with a lengthy life, although many restrictions are imposed on the patient.

Our concepts about fixation of abdominal organs has to be revised. Fixation is only relative. When anomalies of rotation occur, certain points tend to remain fixed. This is usually true of the second and third portions of the duodenum. Here we demonstrate the second and third portions of the duodenum within the hernial contents away from the vertebrae and the posterior abdominal wall. In view of this demonstration we can assume that the pancreas is in these contents since, anatomically, the head and neck of the pancreas lies in the curve of the duodenum. Another unusual feature is the marked elongation of the calcified mesenteric vessels, which are clearly seen in the lateral roentgenograms.

An umbilical hernia is a herniation or separation in the depression at the middle of the abdomen where the umbilical cord of the fetus was attached. Watson, however, states that an umbilical hernia, in adults, is a protrusion of a peritoneal sac with or without contents through the abdominal ring. Some authors believe that, with few exceptions, an umbilical hernia is not a protrusion through the navel scar, but about it.

There are five points on the posterior surface of an umbilicus where herniation can take place. They are: into the umbilical vein, into one of the umbilical arteries, into the urachus, or directly in the center of the umbilicus through the thinned-out fascia of Richet. Parsons states that the umbilicus is the strongest part of the abdominal wall, or hernia would be more frequent there.

In adults, umbilical hernia occurs more frequently in women than in men; the proportions being four to one.

The majority of existing umbilical hernias are due to defective closure of the umbilical canal, leaving a congenital opening. Though many of these umibilical hernias are life long in duration, it is surprising how many of the patients date the appearance of the umbilical hernia to a recent time. Many of these patients have small hernias which are recognized only when another factor makes them enlarge. This patient dated the onset of her umbilical hernia at a time when she fell at the age of twenty years, thirty-four years ago. There was an injury to her umbilical area complicated by an infection. Neglect is another factor which accounts in part for the presence of massive umbilical hernias. This would account for the frequency of massive umbilical hernias in Africa and in other areas of substandard medical care.

The umbilical hernia in adults becomes massive because of neglect; for while those in children tend to remain stationary, those in adults have a tendency to become progressively larger and may become enormous. Besides, the etiological factors are continually exerting their influence aided by the degeneration of muscles as age advances.

Many etiologies are proposed for umbilical hernia. In this case we have factors of trauma, infection, repeated pregnancies, diabetes, and endocrine dysfunction, and a manipulative procedure associated with the birth of a child who is now sixteen years old. The history indicates that the hernia, after the fall, made imperceptible increases in size until immediately following an internal podalic version for the extraction of a 5 pound, 4 ounce girl, when the hernia began to increase notably in size and has now reached immense proportions.

The most usual contents of massive umbilical hernias are omentum and a loop of transverse colon. This, perhaps, is due to their anatomical position in the abdomen. The literature reports cases of loops of small intestine, and sometimes, the cecum, even stomach and liver, and in a rare case, the uterus. White, in reporting a series of umbilical hernias in bad risk patients, noted the omentum commonly occupied the sac and was frequently accompanied by the transverse colon (when the small intestine was present it was usually jejunum). O'Leary and Clymer reported a series of 33 cases in which the contents were adherent; omentum in 17, omentum and small intestine in 7, adherent colon

and omentum in 2, and no structures in 7. This case is then notable because of its multiplicity of contents: the entire gastrointestinal tract from the cardiac end of the esophagus to the rectum, and possibly the left kidney. Congenital umbilical hernias and eventrations commonly contain the entire abdominal viscera, but the adult umbilical hernias, even the massive ones, seldom contain more than a comparatively small portion of the gastrointestinal tract. These instances are usually those of isolated organs or loops of intestine.

Alexander Lewitan, M.D.
405 Clinton Ave.
Brooklyn 5, N. Y.

REFERENCES

1. Balch, F. G., Jr. Pneumoperitoneum due to perforation of transverse colon in umbilical hernia. *New England J. Med.*, 1940, *222*, 1034–1035.
2. Cove, H. W. In: A Textbook of Surgery. By American Authors. Edited by F. Christopher. W. B. Saunders Company, Philadelphia, 1942, pp. 1387–1390.
3. Cullen, T. S. Diseases of the Umbilicus. W. B. Saunders Company, Philadelphia, 1916, pp. 459–480.
4. Iason, A. H. Hernia. The Blakiston Company, Philadelphia, 1941, pp. 816–858.
5. McGlannan, A. Massive umbilical and ventral hernias. *Surg., Gynec. & Obst.*, 1915, *20*, 700–704.
6. O'Leary, C. M., and Clymer, C. E. Umbilical hernia. *Am. J. Surg.*, 1941, *52*, 38–43.
7. Parsons, H. H. Infantile (acquired) hernia at umbilicus in soldiers. *Military Surgeon*, 1940, *87*, 298–300.
8. Watson, L. P. Hernia. C. V. Mosby Company, St. Louis, 1945, pp. 344–365.

APPROACHES TO LIVING ANATOMY

By JAMES O. BROWN*
Daniel Baugh Institute of Anatomy, Jefferson Medical College
PHILADELPHIA, PENNSYLVANIA

THE study of living anatomy is a vivid experience. Long lasting and valuable impressions are thus created within the minds of freshman medical students. Unfortunately, however, preclinical curricula are not, in general, arranged to accommodate much of this teaching facet until after the basic observations and static relationships of cadaveric anatomy have formed an established pattern of thought. Some initial ideas gained solely from the dissection of the dead body persist as deeply entrenched misconceptions that lead to confusion and difficulty when patients are examined in subsequent years. The dynamics of certain fundamental concepts become meaningful at the dissecting table when a companion study of living anatomy is combined with the dissection as a regular part of the course in gross anatomy.

Within the scope of its own limitations, the importance accorded dissection should not be discounted. Yet, in the training of the catechumen, a concomitant study of the living body is of inestimable value. Each approach complements the other; each possesses its own specific advantages. The merits to be derived from such an association are sufficiently obvious so as to render further elaboration of the benefits unnecessary.

Bardeen[1] and Stockard[6] not only advocated but exercised in a practical way two desirable approaches to living anatomy. These were (1) physical examination by means of inspection and palpation, *i.e.*, muscle functions, etc., of the nude living individual, and (2) limited roentgenoscopic demonstrations combined with a study of roentgenograms. Kuhlenbeck[4] reiterated these two approaches, discussed additionally, the potential worth of (3) the use of reflected light for body cavity examinations, and (4) the demonstrations of nerve functions, and concluded that such class procedures were allocated properly to specific specialty courses beyond gross anatomy.

In addition to these four categories, and from a functional standpoint, "freshman clinics" furnish another approach to the study of living anatomy. Both "freshman clinics" and roentgenoscopy are successful teaching practices in anatomy in some medical schools; one or the other or none of these activities forms a part of the first year's work in others.

"Freshman clinics" introduce the beginner to the experience of seeing patients. Different specialists bring cooperative inpatients and/or out-patients before the anatomy class for observation. This affords an opportunity for each student to determine individually the practical applications of anatomy during the discussions and demonstrations of the cases by the clinicians. In a few medical schools, "freshman clinics" meet weekly throughout the gross anatomy course; in others, they vary in accordance with the number of different cases available for presentation. "Freshman clinics" are stimulating events amid a long and confining course, but, also, they better equip the student to encounter the increased responsibilities of the second year. The vividness of functional anatomy may be portrayed with even greater impact, in some instances, through the use of the roentgenoscope. Four roentgenoscopic demonstrations have become a scheduled part of the course in gross anatomy at the Woman's Medical College of Pennsylvania since 1945. These are (1) upper extremity, including the shoulder girdle; (2) lower

* The "freshman clinics," roentgenoscopy and the procedures for the roentgenoscopic demonstrations were introduced into the gross anatomy course in the Woman's Medical College of Pennsylvania during the years 1944 and 1945 by the author, then Acting Head of the Department of Anatomy.

extremity; (3) digestive tract; (4) thorax. A correctly adjusted and properly operated roentgenoscope that is constantly controlled is not dangerous to any participant. Individuals who served as subjects for these demonstrations volunteered from the class,* a practice not uncommonly followed in some medical schools. Jones,[3] Mainland,[5] and others, have made use of volunteer medical students for special studies in living anatomy, some approaches to which were through roentgenoscopy.

In order to insure an adequate view of the roentgenoscopic screen by everyone, over-crowding near the instrument must be avoided. A group of four individuals plus a volunteer from another group (now in the capacity of an observer) is not too large for the maximum convenience of all concerned; one person from each group of four volunteers to be the subject for the demonstration. Demonstrations (1), (2) and (4) require one volunteer per group; procedures for demonstration (3) require three volunteers per group. In the latter instance, a minimum of seven individuals must attend each roentgenoscopic session.

Upper and lower extremities and thorax can be viewed roentgenoscopically without special preliminaries other than the removal of encumbrances (rings, bracelets, shoes, etc.). A variety of possible positions and movements provides the observers with a wealth of material for discussion.

Except for the teeth and the bones of the jaws, the digestive tract is not visible roentgenoscopically, hence the necessity for using a contrast meal for visualization of this body part. The contrast meal can be taken in a variety of ways to emphasize different aspects of the alimentary canal. A gelatin capsule (No. 00) filled with barium sulfate can be held between the teeth, then swallowed. Observed roentgenoscopically, its course can be followed through the oral cavity and into the esophagus in which it is delayed momentarily at one or more of the esophageal constrictions, providing no water is taken to facilitate swallowing. The taking of a second capsule allows for adequate observation of this demonstration. The capsules can be identified subsequently in the stomach. Cookies baked with barium sulfate in them may be eaten to demonstrate mastication and characterize further essentially the same features shown by swallowing the capsules.

The same volunteer† then follows this by drinking a glassful of contrast meal (the barium sulfate-water mixture may be flavored with a powdered chocolate preparation if desired). Its course can be followed readily on the roentgenoscopic screen; the startling rapidity with which the meal reaches the stomach can be fully appreciated. The esophagus becomes well outlined; its position in the retrocardiac space and the constrictions along its course are demonstrable. The shape of the filled stomach permits a rapid classification of its type; the gas bubble in the fundus appears in sharp contrast to the radiopaque meal. Peristaltic waves along the gastric wall expel the contents, and shadows corresponding to rugae may be seen in the corpus region as the stomach empties. The pyloric canal, the duodenal cap and other parts of the duodenum may then be visualized.

A second volunteer, also having eaten nothing for several hours previously, consumed a glassful of the contrast meal mixture approximately one hour prior to the demonstration. The result, roentgenoscopically, in this case is a rather extensive but somewhat indefinitely defined shadow in the lower abdomen and upper pelvis representing the overlapped "coils" of the jejuno-ileum.

The third volunteer whose diet is at no time restricted drank the barium meal mixture about 11:00 P.M. of the evening preceding the demonstration. Observed roentgenoscopically, the radiopaque material can be located distinctly outlining the colon.

* Student response has been spontaneous and abundant.

† The volunteer who just took the capsules, swallowed the barium meal mixture at the time of the roentgenoscopy, also. Note: No food should be ingested during a period of five to six hours or longer, immediately prior to taking the contrast meal, a moderate amount of fruit juice excepted.

Departures from the usually described "textbook" position of the gastrointestinal viscera in persons are the rule rather than the exception when these body parts are seen roentgenoscopically during the study of living anatomy. Such realities point up the intrinsic worth of these procedures.

The belief that extra hours are needed to accommodate a study of living anatomy is widespread; in reality, it is a spurious conviction. Paradoxical as it may first appear, additional time beyond that regularly allotted in the curriculum for anatomy is unnecessary for the inclusion of such a study. Time spent for "freshman clinics" and roentgenoscopy is not time consumed extraneously. Rather the reverse appears to be true. When living anatomy becomes a partner to the dissection, the students seem to be more alert at grasping the fundamental relationships and thereby develop better workable concepts of parts and regions in much less time.

There are two additional approaches to the study of living anatomy. Neither has been widely practiced to date; both should be exploited for their potential advantages and benefits. They are: (1) motion pictures of roentgenoscopic examinations of body regions seen during routine and special clinical observations other than those observed on student volunteers. More research into this technique and further development of the processes involved are needed before this approach can enjoy wide application. (2) The hiring of a professional model would permit the demonstration of surface anatomy and the tracing of surface projections of deep structures for visualization on a living person. One recent indication of a trend in this direction may be found in Cunningham's Textbook of Anatomy[2] in which photographs of a living nude model are shown illustrating the surface appearance of various body regions with special reference to muscle positions. Furthermore, the amount of body surface exposed publicly (beaches, swimming pools, cinema, etc.) has increased so much that now almost everyone accepts without question costumes which, for all intents and purposes, are designed to reveal almost the entire body. In view of this, the utilization of a professional nude model as an adjunct to the teaching of anatomy in properly supervised classes would be above reproach.

CONCLUSIONS

1. Dissection allows for the study of fixed relationships in the cadaver only. Some ideas of basic morphology derived in this way disagree with corresponding situations in the living individual. A study of living anatomy directs thought toward function and cloaks the dissection with greater realism.

2. "Freshman clinics" and roentgenoscopy offer excellent opportunities for a living anatomy study in the first year of medical school. Student participation is encouraged whenever practicable.

3. Pertinent suggestions for procedures in the taking of a contrast meal for roentgenoscopic visualization of the alimentary canal are given.

4. When scheduled concomitantly, a study of living anatomy complements the dissection and helps speed up the learning process; additional hours are not necessary.

5. Refinements in the technique of cineroentgenoscopy would add great impetus to the utilization of such an approach for studying regions impossible to observe in student volunteers.

6. The values to be gained from demonstrations on a living nude model have been re-emphasized as an excellent means of visualizing surface anatomy.

Finally, an expression of gratitude is due to the Department of Medicine in the Woman's Medical College of Pennsylvania for its generosity in having made available in the past the unrestricted use of the roentgenoscope in the Heart Station.

Daniel Baugh Institute of Anatomy
307 South 11th St.
Philadelphia 7, Penna.

REFERENCES

1. Bardeen, C. R. Value of roentgen-ray and living model in teaching and research in human anatomy. *Anat. Rec.*, 1918, *14*, 337–340.
2. Cunningham, D. J. Text-book of Anatomy. Edited by Brash, J. C., and Jamieson, E. B. Eighth edition. Oxford University Press, New York, 1943.
3. Jones, R. L. Human foot. Experimental study of its mechanics, and role of its muscles and ligaments in support of arch. *Am. J. Anat.*, 1941, *68*, 1–39.
4. Kuhlenbeck, H. Teaching of "living anatomy." *J. A. Am. M. Coll.*, 1939, *14*, 319–322.
5. Mainland, D. Anatomy as a Basis for Medical and Dental Practice. Paul B. Hoeber, Inc., New York, 1945.
6. Stockard, C. R. Discussion—Teaching of anatomy and inculcation of scientific methods and interest. *Anat. Rec.*, 1918, *14*, 448–450.

MONOPHEN

A NEW MEDIUM FOR ORAL CHOLECYSTOGRAPHY*

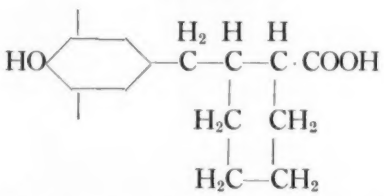
By MILTON G. WASCH, M.D., *and* BERNARD S. EPSTEIN, M.D.
BROOKLYN, NEW YORK

ORAL cholecystography has achieved a prominent position in the diagnosis of gallbladder disease. With the advent of a reliable method for visualizing the gallbladder few patients are treated for biliary tract disease without roentgenologic investigation. Tetraiodophenolphthalein has been superseded by beta-(4-hydroxy 3,5-diiodophenyl)-alpha-phenylpropionic acid (priodax) as a diagnostic medium. This has proved so reliable that oral cholecystography has replaced the intravenous technique almost completely. Nevertheless, a variable but definite number of patients still complain of unpleasant side reactions after taking priodax. Even though the incidence of such reactions is less than was encountered with tetraiodophenolphthalein further improvement in cholecystographic media to attain a lesser degree of side reactions and equally good visualizing properties was sought.

Epstein, Natelson and Kramer[1] investigated a new series of compounds devised by Natelson which had the property of opacifying the gallbladder. These were members of a family of organic compounds containing a single phenyl ring bearing two iodine atoms with varying side chains. It was believed that reduction of the number of phenyl rings would diminish the physiologic side effects. These compounds are excreted principally through the urinary tract after passing through the biliary system, the various substances having different ratios of distribution and excretion through the renal and hepatic tracts, depending on their side chain structures.

Grayzel and Natelson[3] reported toxicity investigations on two compounds in this group and found that doses of 1,000 mg. per kilogram were readily tolerated by cats. The intravenous lethal dose was found to be from 400 to 500 mg. per kilogram. Further toxicity studies were made on the substance ultimately selected for clinical investigation, 2-(4-hydroxy-3,5-diiodobenzyl)-cyclohexane carboxylic acid, designated for clinical use as monophen.

FORMULA



2-(4-hydroxy-3,5-diiodobenzyl)-cyclohexane carboxylic acid (monophen)

It was found that oral administration of monophen to cats did not produce death in doses varying from 600 to 1,800 mg. per kilogram, and that intravenous administration caused no untoward effects in doses up to 200 mg. per kilogram.[4] Postmortem examination of the cats sacrificed after seven days showed no visceral disturbances.

Laboratory investigations of hepatic function after the oral ingestion of 5 grams of monophen were made in 5 normal men who were studied immediately before and ten days after taking the drug. The excretion studies showed that almost complete elimination occurred through the urinary tract within forty-eight hours. Chemical investigations included thymol turbidity tests, cephalin flocculation tests, determinations of alkaline phosphatase, phosphorus, total protein, albumin-globulin ratios, urea nitrogen, icterus index, cholesterol values and van den Bergh tests. No change in these values was detected after oral cholecystography with monophen.

Being assured that monophen was a nontoxic cholecystographic agent, we began

* From the Department of Radiology of the Jewish Hospital of Brooklyn, Brooklyn, New York.

to use it routinely. Over a period of three years we and our confrères employed it in over 2,500 patients. Detailed notes were kept on the reactions reported by the first 1,000 patients. These were gathered by other observers as well as by ourselves. The patients were questioned concerning nausea, griping, vomiting, diarrhea, pain on urination or any other untoward symptom which may have been noted after taking monophen. The data gathered are summarized in Table 1.

Table I

Number of Cases	Symptoms None	Nausea	Cramps	Vomiting	Diarrhea	Burning on Micturition
1,000	66%	2% severe 10% mild	1.5% severe 7.5% mild	1%	1% severe 8% mild	3%

Comparison of the effects of monophen with those of priodax as reported by Fong[2] reveal that the side effects of monophen are definitely fewer. Severe reactions with monophen were infrequent. Thus, intense diarrhea was noted in only 1 per cent. The other 8 per cent who had diarrhea had from one to three soft bowel movements in the morning, usually without discomfort. The patients who complained of griping pain often volunteered the information that the discomfort was mild and tolerable. Nausea likewise was usually mild and vomiting was rare. Burning on urination was infrequent, occurring in 3 per cent of our patients. The fact that 66 per cent of the patients had no unpleasant symptoms after taking monophen is worthy of emphasis.

Monophen was clinically tested in several forms, including tablets, suspensions, powders and capsules. The tablet and powder forms at times left some of the opaque medium scattered in the colon, but suspending the monophen in polysorbate 80 (tween) resolved this difficulty to a great extent. The form finally adopted for clinical use was a soft gelatine capsule containing monophen in a suspended state. While small particles of the compound are seen in the right colon in approximately 8 per cent of the patients given the capsules, the diagnostic quality of the films has not been perceptibly impaired.

The patients are instructed to take the capsules as quickly as desired, using water or fruit juice as an aid in swallowing. The capsules are given the night before the examination, a plain roentgenogram of the right hypochondrium having been made previously. The meal preceding the ingestion of monophen does not appear to have any definite influence on the examination. We have used fat-free meals, light suppers and ordinary meals. It is our impression that a fat-rich meal will empty the gallbladder before the entry of the dye, thus permitting the opacified bile to visualize the gallbaldder with better density. The examination is continued twelve hours later, at which time cone-down films of the gallbladder are taken. A post-evacuation film two hours after a fatty meal concludes the study.

The dosage of monophen varies from 3 to 4 grams given in six to eight capsules. The acceptance of the capsule by the patient has been without comment. There was no burning sensation in the throat after taking the capsules, probably due to its gelatine envelope. Double doses are unnecessary, and very satisfactory opacification has been obtained in patients weighing well over 200 pounds with the 4 gram dose. As a rule, 3 grams are given to patients weighing less than 150 pounds, and 4 grams to those over. Divided double doses were given to 20 patients, but no difference in visualization was perceived as compared with the standard dose.

Scrupulous attention to roentgenographic technique is required to obtain optimum results. The importance of adequate com-

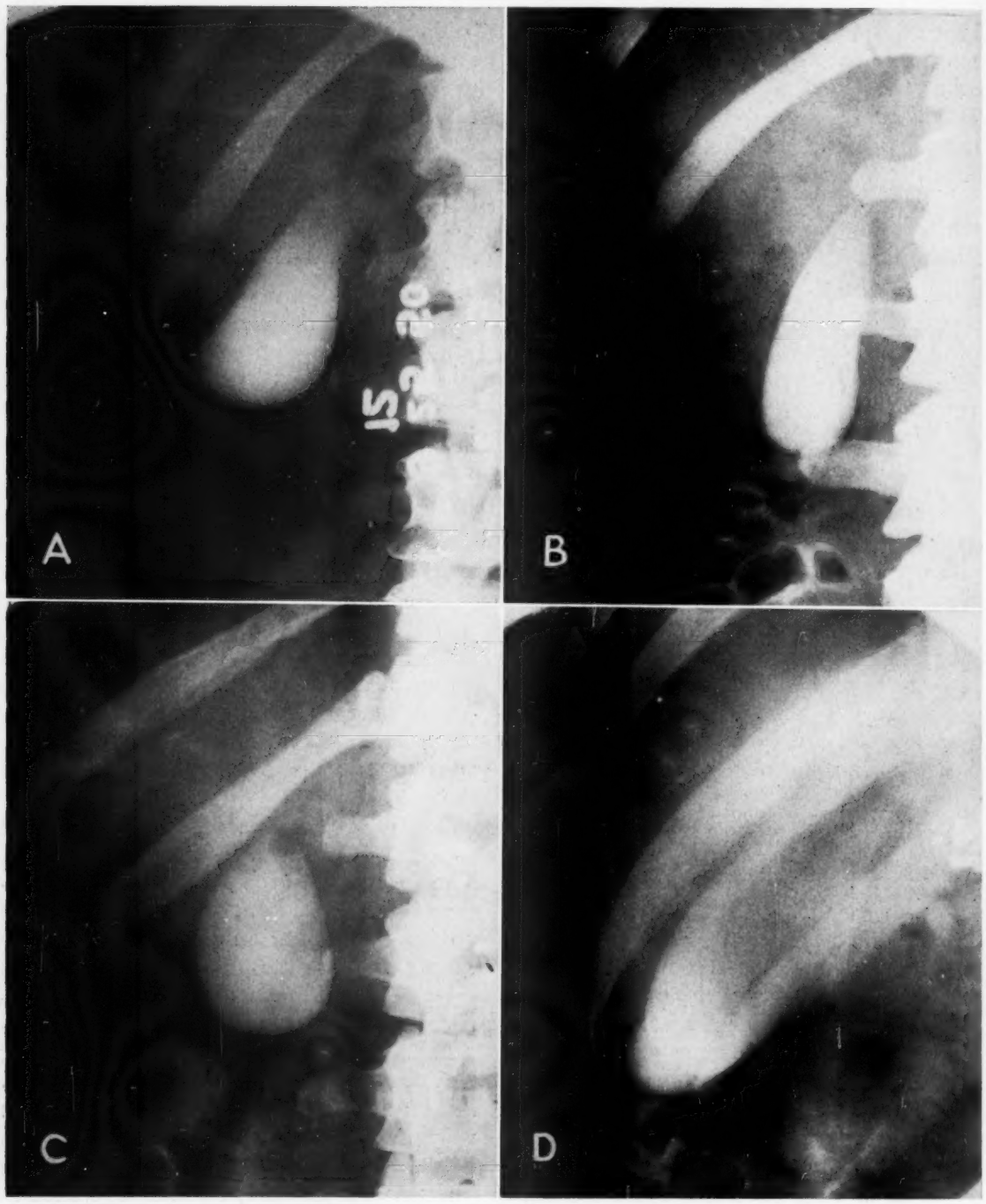


Fig. 1. (*A*) (*B*) (*C*) (*D*). Four normal oral cholecystograms. A phrygian cap is seen in (*D*).

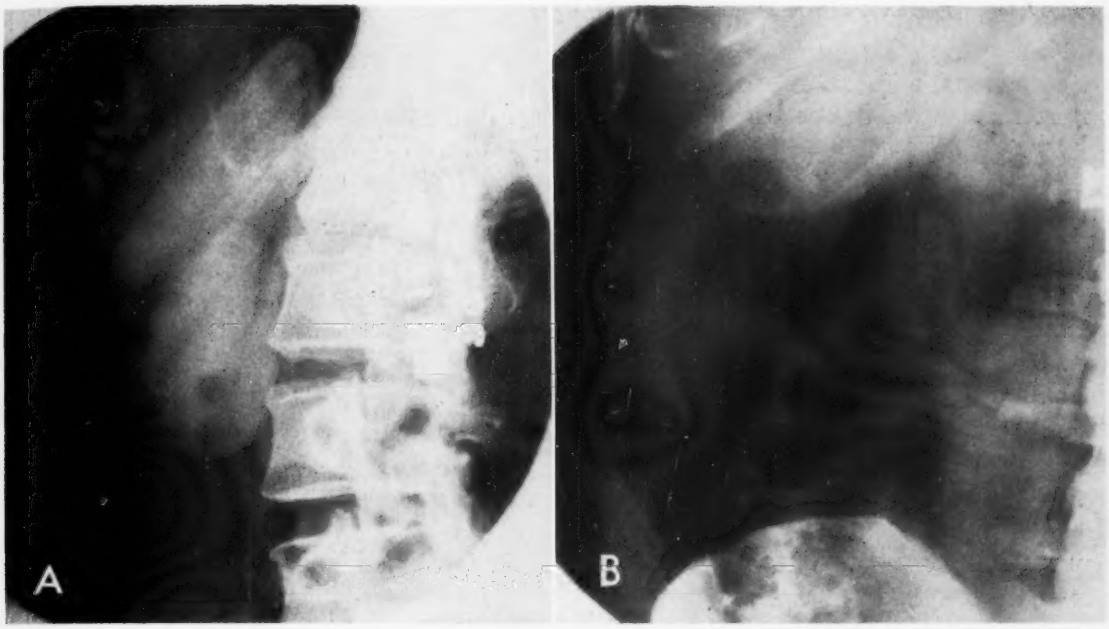


Fig. 2. (*A*) (*B*). Oral cholecystograms showing gallstones in functioning gallbladders.

pression and proper cone-down examinations in the posteroanterior, oblique and erect postures should not be underestimated. Variations in intensity may sometimes be required, and a somewhat overexposed film may be more diagnostic when the question of faint negative shadows is considered.

In order to check the accuracy of our diagnoses 50 consecutive cases which came to operation after cholecystography with monophen were reviewed. As with other

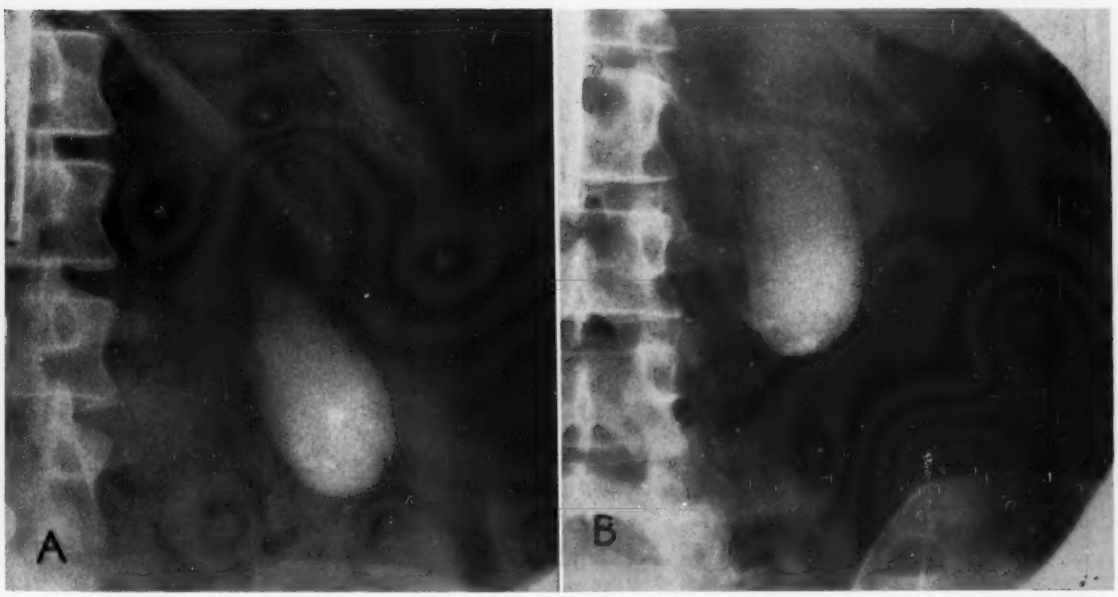


Fig. 3. (*A*) Oral cholecystogram, taken in the recumbent position, showing stones in a functioning gallbladder. (*B*) Cholecystogram of the same patient taken in the erect position. The stones have fallen to the bottom of the sac.

forms of cholecystography, it was found that our observations were reliable and that the clinicopathologic and roentgenologic observations were in the usual accord.

CONCLUSIONS

1. Monophen, 2-(4-hydroxy-3,5-diiodobenzyl)-cyclohexane carboxylic acid, is a safe, well tolerated and reliable opaque medium for oral cholecystography.

2. The dosage varies from 3 to 4 grams depending on whether the patient weighs more or less than 150 pounds. Double doses have been found unnecessary.

3. Side reactions occur less frequently than with other opaque media used for cholecystography.

4. The roentgenologic results compare favorably with those obtained with other compounds.

Milton G. Wasch, M.D.
871 Park Place
Brooklyn, N. Y.

REFERENCES

1. EPSTEIN, B. S., NATELSON, S., and KRAMER, B. New series of radiopaque compounds; chemical structures, channels of excretion and roentgenographic uses. AM. J. ROENTGENOL. & RAD. THERAPY, 1946, *56*, 201–207.
2. FONG, E. E. Some experiences with priodax. *Radiology*, 1946, *46*, 583–585.
3. GRAYZEL, D. M., and NATELSON, S. Toxicity studies of *a* (4-hydroxy-3, 5-diiodo-benzyl-n-butyric acid) and *a* (4-hydroxy-3, 5-diiodo-benzyl-n-caproic acid); compounds proposed as gall bladder contrast agents. *J. Lab. & Clin. Med.*, 1947, *32*, 292–295.
4. GRAYZEL, D. M., and NATELSON, S. Unpublished observations.

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Thirty-third Annual Meeting: Hotel Claridge, Atlantic City, N. J., June 7–9, 1951.

EDITORIALS

"NOT BY BREAD ALONE"

IT IS perhaps only natural that the specialist depends for the solution of any problem primarily on his own particular modality. To the mathematician all problems should be susceptible of mathematical analysis; to the statistician, statistical analysis; and to the roentgenologist, analysis of films and roentgenoscopic observations. It is fitting that this should be so, but only if the potential fallibility of the method is recognized. The roentgenologist is often quite ready to admit the deficiencies of his method, but in spite of this only too frequently appears unwilling to utilize the simple knowledge and methods that might make up for some of the deficiencies. This may sometimes be observed in the "film reading session" which tends to stultify the results of a superb technique. The guess made on the basis of statistics, the brilliant deduction made from the observed evidence may be thoroughly entertaining, but the educational value is minimal.

Particularly in the study of congenital heart disease the roentgenologist must make available for his interpretation all the pertinent facts of history, physical examination and simple laboratory procedures. Possibly this information should be supplied by the referring clinician, but the roentgenologist has the opportunity of becoming a good cardiologist. It is not shameful to keep a stethoscope in the roentgenoscopic room. No rules are broken if before roentgenoscopy the patient is examined for cyanosis, clubbing of the fingers, or the location and quality of a cardiac murmur. Rather the manipulator of a screen and filming device will become something of a clinician and a much better roentgenologist.

If reliance is placed only on the film and roentgenoscopic examination of the malformed heart numerous stupid errors will be made or, as bad, no interpretation of the findings will be made at all. Experience has taught that it is rarely wise to make a diagnosis of the presence of a patent ductus arteriosus unless the heart murmur is consistent with the diagnosis, as the roentgen signs can be simulated by other lesions. It is frequently necessary to depend on the information provided by the electrocardiogram to determine ventricular hypertrophy. It is not difficult for the roentgenologist to recognize enlargement of a cardiac chamber, but it may be extremely difficult or impossible to recognize hypertrophy, particularly in the presence of enlargement of other chambers. Yet the diagnosis may be dependent entirely on the recognized balance between chamber size and hypertrophy of the ventricular muscle. Both an auricular septal defect and a large ventricular septal defect will show enlargement of the right ventricle, but unipolar chest leads will show that the ventricular defect is associated with left ventricular hypertrophy.

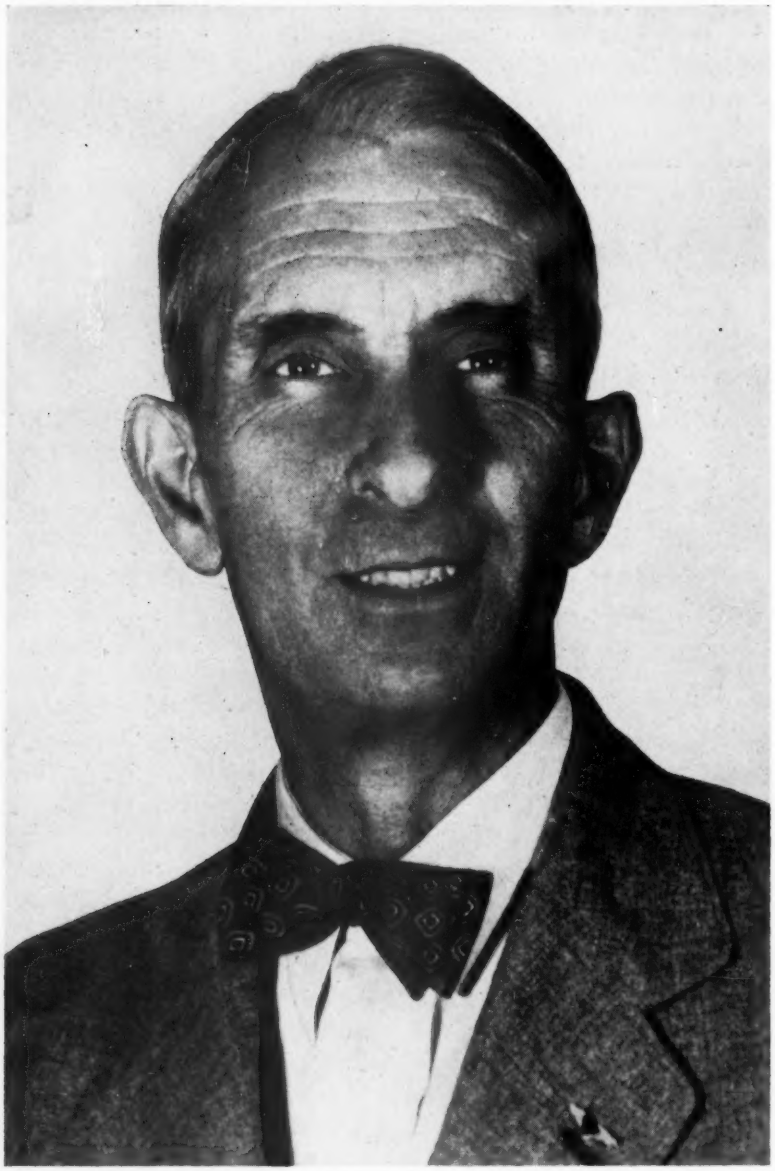
The correct diagnosis of a congenital malformation of the heart or of the great vessels can usually be made from an analysis of the roentgen findings, the history, the physical examination, and the electrocardiographic record. In many instances this may be anatomically exact, more often it may have to be a diagnosis on broad physiologic grounds. Unless this simple approach to the problem of congenital heart disease is made and found insufficient then there is no excuse for turning to complicated ancillary methods. Angiocardiography has in the past contributed greatly to our understanding of congenital malformations and will un-

doubtedly continue to do so, but it is not a simplification. First steps come first, and the first steps are an understanding of the morbid anatomy and the disturbances of physiology of congenital heart disease. Without this and without the knowledge of the effect produced upon the patient, the use of angiocardiography becomes simple gadgetry; the supreme example of faith in a single modality.

Edward B. D. Neuhauser, M. D.

The Children's Hospital
Boston 15, Mass.

As this issue goes to press, word has been received of the death of Dr. Harry M. Imboden of New York, on June 13, 1951, at the age of seventy-two. Dr. Imboden was a pioneer radiologist and was Editor of this Journal from 1918 to 1923. A biographical account of Dr. Imboden will appear in an early number of the Journal.



ROBERT BURBIDGE TAFT, M.D.
1899–1951

THE many friends of Dr. Robert B. Taft will be grieved to learn of his death on April 16, 1951.

Dr. Taft was born in Charleston, South Carolina, on September 20, 1899. His father, Dr. Augustus R. Taft, who was a very capable and affable man, specialized in radiology and was a member of the American Roentgen Ray Society and Radiological Society of North America. The elder Dr. Taft began his specialization in an era of rather primitive equipment such as the induction coil, static machine and gas tube. His son, being talented along

electrical lines, spent part of his time during his youth keeping the equipment in repair. These contacts stimulated the son's interest in radiology which served to further his father's excellent work.

After attending Porter Military Academy, Robert Taft was graduated from the College of Charleston and the Medical College of the State of South Carolina in 1923, receiving the degrees of B.S. and M.D. His internship and residency in radiology were served at Bellevue Hospital. He received further post-graduate training at the University of Michigan and the University of Vienna. Then he became his father's assistant until the latter's death in 1927. Dr. Robert Taft became a member of the American Roentgen Ray Society and the Radiological Society of North America in 1926 and was elected a Fellow of the American College of Radiology in 1933.

He practiced the specialty of radiology in his private office, was radiologist of Baker Sanatorium, professor of radiology and director of isotope therapy at the Medical College of the State of South Carolina.

His experiences in early life increased his interest in the physical aspects of radiology. In addition to making a close study of published facts, he carried on exhaustive research studies, the products of these being important additions to our apparatus. His ingenuity was well matched by his ability as an artisan and in his laboratory and workshop he would fabricate the instruments which he designed. No doubt many of his experiments were fruitless and yielded only disappointment and lost time as is so often the case in investigative work.

In 1926, which was one year prior to the acceptance of the roentgen as an international unit, he made an iontoquantimeter after Bachem's design and the accuracy of this instrument was remarkably close to that of the modern r-meter. Dr. Taft's improvement in the instrument consisted of a Ford spark coil and batteries which made a satisfactory charging device. His experiments in electronics produced a very simple and reliable roentgen therapy output meter in 1937.

For the past several years Dr. Taft was particularly interested in lost radium. His first paper on this subject won for him the Jefferson Medal which was awarded by the South Carolina Academy of Science in 1929. The instruments, called "Radium Hounds," used and made by him for the purpose of locating radium, were at first electroscopes. Later the Geiger counter in portable form proved to be much more sensitive. His enthusiasm was stimulated by many successful radium searches in various parts of the country and by numerous descriptions of radium hunts made by others. He wrote a book on this subject entitled "Radium Lost and Found" which was published in 1938 and revised in 1946. This volume is packed with useful information and replete with human interest stories.

Exhibits in the form of various gadgets of his fabrication have been displayed at the meetings by Dr. Taft and the values of these have been proved in the American Roentgen Ray Society by the award of the Silver Medal in 1936 and Certificates of Merit in 1937 and 1942. Honorable mention was won for an exhibit on the "Radium Hound" at the meeting of the Radiological Society of North America in 1938. He received Honorable Mention at a joint meeting of the two societies named above, in Chicago in 1944, for an exhibit proving that films were fogged by radioactive contamination of cardboard fillers.

At the first examination held by the American Board of Radiology in 1935 Dr. Taft became a diplomate of the Board. He was editor of the Department of Technique of the American Journal of Roentgenology and Radium Therapy for many years and gave refresher courses at meetings of the American Roentgen Ray Society. For the Radiological Society of North America he was Counselor for South Carolina and was elected second vice-

president in 1943. The Institute of Nuclear Physics at Oak Ridge, Tennessee, chose him as a medical consultant and he made many visits there in this capacity. He was appointed head of the radiological division of the Charleston Civil Defense organization in November, 1950.

Dr. Taft found time for other activities besides those devoted to radiology. He obtained the first private pilot's license issued by the Charleston airport and was one of the Board of Governors of this airport from 1935 to 1949. He was an accomplished photographer and built a camera with which he made excellent aerial photographs during solo flights. His investigative inclinations and radiological skill prompted his attention to the luminous dials of airplane instruments with the conclusion that no harm to the pilot existed. These observations he had published in a 1941 issue of "Newsweek."

Music held considerable interest for Dr. Taft and in his earlier years his talent was directed toward the guitar. Having taken a course in music theory he decided that there must be some simple way of teaching the fingering technique. So he devised a circular gadget which pictured the various fingering positions used. In his later years he became an excellent accordionist, and he also derived much pleasure from boating and water skiing.

Memberships were held by Dr. Taft in Kappa Alpha Order, St. Cecilia Society, New England Society, Rotary Club and Carolina Yacht Club. He was a commissioner of the Charleston Museum. Having taken a very active part in masonry, in December, 1950, he was installed as Master of Union Kilwinning Lodge No. 4, Ancient Free Masons.

Survivors include his wife, the former Miss Mary Joyce Steadman, and a daughter Miss Joyce Shannon Taft, both of Charleston; three sisters, Mrs. Taft Walker and Mrs. J. H. Lucas, Jr., both of Charleston, and Mrs. Ladson Mills of Washington, D. C.

Dr. Taft will be greatly missed by a host of friends in and out of his profession. His passing terminates a brilliant career of a gentleman, a scholar and a teacher whose zeal, resourcefulness and accomplishments should be an inspiration to all.

PERCY D. HAY, JR., M.D.

RESOLUTION OF THE GEORGIA RADIOLOGICAL SOCIETY ON THE DEATH OF DR. ROBERT B. TAFT

The Georgia Radiological Society, in semi-annual session, at Augusta, Georgia, on April 18, 1951, has unanimously adopted the following resolution:

"WHEREAS, Dr. Robert Burbidge Taft went to his final reward on Monday, April 16, 1951. We had experienced the happy privilege of having Dr. Taft as a guest speaker at one of our previous meetings, and the members of the Georgia Radiological Society knew, admired, and loved him. His vast store of radiological knowledge was surpassed only by his great personal attraction. He was always ready to help other radiologists, particularly with problems in radiation physics and therapy. The radiologists of Georgia feel a personal loss in the death of Bob Taft. As expressed by his friend Robert Drane, 'Bob Taft died, as he lived, without ostentation.'

"RESOLVED, that a copy of this resolution be sent to Mrs. Robert Taft, to the Secretary of the South Carolina Radiological Society, to THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, and to *Radiology*."

ROBERT C. PENDERGRASS, M.D.
Secretary

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Shoreham Hotel, Washington, D.C., Sept. 25–28, 1951.

American Radium Society
Secretary, Dr. J. E. Wirth, U. S. Marine Hospital, Baltimore, Md. Annual meeting: Hotel Claridge, Atlantic City, N. J., June 7–9, 1951.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y., Annual meeting: Palmer House, Chicago, Ill., Dec. 2–7, 1951.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6.

Section on Radiology, American Medical Association
Secretary, Dr. P. C. Hodges, 950 E. 59th St., Chicago, Ill. Meets Atlantic City, N. J., June 11–15, 1951.

Alabama Radiological Society
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

Arizona Radiological Society
Secretary, Dr. R. Lee Foster, 507 Professional Building, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, Dr. J. D. King, 35 Linden Ave., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

Cleveland Radiological Society
Secretary, Dr. J. R. Hannan, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
Secretary, Dr. Paul E. RePass, 306 Republic Bldg., Denver 2, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

Connecticut Valley Radiologic Society
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. J. C. Cook, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

East Bay Roentgen Society
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

Florida Radiological Society
Secretary, Dr. Nelson T. Pearson, 1109 Huntington Bldg., Miami, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Greater Miami Radiological Society
Secretary, Dr. T. M. Berman, 350 Lincoln Rd., Miami Beach, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

Houston Radiological Society
Secretary, Dr. F. M. Windrow, 1205 Hermann Professional Bldg., Houston, Texas. Meets fourth Monday each month.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society.

Kansas Radiological Society
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

Kentucky Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

Kings County Radiological Society
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

Maine Radiological Society
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

* Secretaries of societies are requested to send timely information promptly to the Editor

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

MID-HUDSON RADIOLOGICAL SOCIETY
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, Sept. to May.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

MISSISSIPPI RADIOLOGICAL SOCIETY
Secretary, Dr. John W. Evans, 621 High Street, Jackson 2, Miss. Meets third Thursday of each month at the Rotisserie Restaurant at 6:30 P.M.

NEBRASKA RADIOLOGICAL SOCIETY
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. L. L. Robbins, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

NEW HAMPSHIRE ROENTGEN RAY SOCIETY
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. J. L. Olpp, 49 Ivy Lane, Tenafly, N. J. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

NORTH CAROLINA RADIOLOGICAL SOCIETY
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

NORTH DAKOTA RADIOLOGICAL SOCIETY
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY
Secretary, Dr. John F. Roach, Albany Hospital, Albany, N. Y. Meets four times a year, the times being announced by the Secretary.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB
Secretary, Dr. C. W. Wauters, 701 High St., Auburn, Calif. Meets at dinner last Monday, every second month, except June, July and August.

OHIO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio. Meets Ft. Hayes Hotel, Columbus, Ohio, May 25–27, 1951.

OKLAHOMA STATE RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Brown, 21st & Xanthus, Tulsa 4, Okla. Three regular meetings annually.

OREGON RADIOLOGICAL SOCIETY
Secretary, Dr. C. T. Jessell, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M.

ORLEANS PARISH RADIOLOGICAL SOCIETY
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

PACIFIC ROENTGEN SOCIETY
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport. Annual meeting, May 18 and 19, 1951, at William Penn Hotel, Pittsburgh, Pa.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. G. P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY
Secretary Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

RADIOLOGICAL SECTION, BALTIMORE MEDICAL SOCIETY
Secretary, Dr. Richard B. Hanchett, 705–6 Medical Arts Bldg., Baltimore, Md. Meets third Tuesday each month, Sept. to May.

RADIOLOGICAL SECTION, CONNECTICUT MEDICAL SOCIETY
Secretary, Dr. Fred. Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY
Secretary, Dr. W. M. Clopton, 3929 Oliver St. N.W., Washington 15, D. C. Meets Medical Society Auditorium, third Thursday, Jan., March, May, Oct. at 8:00 P.M.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. Roy G. Giles, Temple, Texas.

RADIOLOGICAL SOCIETY OF GREATER CINCINNATI
Secretary, Dr. L. J. Gibboney, 831 Carew Tower, Cincinnati 2, Ohio. Meets first Monday each month, at 7:30 P.M., September to May, inclusive.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. Peter Gianquinto, 685 High St., Newark, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. George Gamsu, 191 S. Goodman St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Meets August 9, 10, 11, 1951, Shirley-Savoy Hotel, Denver, Colorado.

ST. LOUIS SOCIETY OF RADIOLOGISTS
Secretary, Dr. D. S. Bottom, 510 S. Kingshighway, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

SAN DIEGO ROENTGEN SOCIETY
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Tuesday at dinner.

SECTION ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

SECTION ON RADIOLOGY, ILLINOIS STATE MEDICAL SOCIETY
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

SHREVEPORT RADIOLOGICAL CLUB
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH BAY RADIOLOGICAL SOCIETY
Secretary, Dr. Charles E. Duisenberg, 300 Homer Avenue, Palo Alto, Calif. Meets second Tuesday each month.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. S. H. Fisher, 107 E. North St., Greenville, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Meets Houston, Texas, Jan. 18 and 19, 1952.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.
University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.
Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.
Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.
Washington State Radiological Society
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.
Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.
X-Ray Study Club of San Francisco
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets Jan. to July, Lane Hall, Stanford Univ. Hospital; July to Dec. San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.
Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.
Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.
Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.
Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.
Canadian Association of Radiologists
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.
Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.
Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.
Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.
Sociedad Argentina de Radiologia, Junta Central Buenos Aires
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.
Sociedad Argentina de Radiologia, Filial del Litoral, Sede, Rosario
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.
Sociedad Argentina de Radiologia, Filial del Sur, Sede, La Plata
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.
Sociedad Argentina de Radiologia, Filial del Centro, Sede, Cordoba
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.
Sociedad Argentina de Radiologia, Filial del Norte, Sede, Tucuman
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.
Sociedad Argentina de Radiologia, Filial de Cuyo Sede, Mendoza.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.
Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.
Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.
Sociedad Colombiana de Radiologia
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.
Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.
Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.
Société Française d'Electro-Radiologie Médicale, and its branches: Société du Sud-Ouest, du Littoral Méditerranéen, du Centre et du Lyonnais, de l'Ouest, de l'Est, et d'Alger et d'Afrique du Nord
Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX^{e}, France.
Ceskoslovenská společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad. USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Societa Italiana di Radiologia Medica
Secretary Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually

India

Indian Radiological Association
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India

AMERICAN ROENTGEN RAY SOCIETY

The Fifty-second Annual Meeting of the American Roentgen Ray Society will be held at the Hotel Shoreham, Washington, D. C., September 25, 26, 27, and 28, 1951. The Preliminary Program and Instructional Courses will be published in the August issue of the Journal. An excellent meeting is anticipated. It is suggested that those who expect to attend the meeting make their reservations with the Manager, Mr. L. Gardner Moore, Hotel Shoreham, Washington, D. C., as soon as possible.

PRELIMINARY PROGRAM
ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The Thirteenth Annual Mid-summer Radiological Conference of the Rocky Mountain Radiological Society will be held at the Shirley-Savoy Hotel, Denver, Colorado, August 9, 10 and 11, 1951. The following will be the guest speakers: Paul C. Aebersold, Ph.D., Oak Ridge, Tennessee; Howard P. Doub, M.D., Detroit, Michigan; Hugh F. Hare, M.D., Boston, Massachusetts; Robert R. Newell, M.D., San Francisco, California; Frederick S. Webster, M.D., Lincoln, Nebraska.

Thursday Morning, August 9, 1951

Registration

Vision by X-Ray. Robert R. Newell, M.D.

Luncheon and Discussion with Guest Speakers

Thursday Afternoon, August 9, 1951

Cysts of the Mediastinum. Howard P. Doub, M.D.

Angiocardiography in Congenital Heart Disease. R. Parker Allen, M.D.

Growth of the Atomic Energy Program. Paul C. Aebersold, Ph.D.

Growth Changes of the Extremity Associated with Tuberculosis of the Hip. Frederick S. Webster, M.D.

Thursday Evening, August 9, 1951

Joint Meeting with Denver County Medical Society

What Isotopes Have to Offer in Medical Practice and Research. Robert R. Newell, M.D.

Lymphoma: A Ten Year Follow-up. Hugh F. Hare, M.D.

Friday Morning, August 10, 1951

Roentgen Procedures in the Management of Pregnancy. Angus K. Wilson, M.D.

Cerebral Angiography. Curtis H. Burge, M.D.

Reliability of Reading Chest Films. Robert R. Newell, M.D.

Lesions Affecting the Cranial Vault. Hugh F. Hare, M.D.

Tarsal Anomalies and Peroneal Spastic Flat Feet. Frederick S. Webster, M.D.
Luncheon and Discussion with Guest Speakers

Friday Afternoon, August 10, 1951

Conditions Affecting the Temporomandibular Joints. Howard P. Doub, M.D.
Symposium on Diseases of the Colon.
Coproliths. H. M. Berg, M.D., and J. R. Williams, M.D.

Friday Evening, August 10, 1951

Banquet—Informal

Saturday Morning, August 11, 1951

Paper by John H. Freed, M.D.
Pulmonary Metastasis. Peter E. Russo, M.D.
Growth of the Atomic Energy Program. Paul C. Aebersold, Ph.D.
Calcifying Tendinitis of the Shoulder: A Critical Study of the Value of Roentgen Therapy. Henry P. Plenk, M.D.
Prepyloric Suspect Lesion. Fay K. Alexander, M.D.
Luncheon and Discussion with Guest Speakers

Saturday Afternoon, August 11, 1951

Annual Picnic

ARIZONA RADIOLOGICAL SOCIETY

Since the number of radiologists and pathologists in Arizona has increased sufficiently to warrant such a move, the Arizona Association of Pathologists and Radiologists in their meeting of April 29, 1951, voted to disband in order to allow the organization of separate associations for the radiologists and pathologists in the state. The Arizona Radiological Society was immediately organized with a membership of fifteen Arizona radiologists. The following officers were elected: *President*, Dr. Maurice Richter, Phoenix; *Vice-President*, Dr. Herbert D. Welsh, Tucson; *Secretary-Treasurer*, Dr. R. Lee Foster, Phoenix. Plans include two regular meetings each year, the annual meeting to be held at the time and place of the meeting of the State Medical Association and the interim meeting six months later.

CHICAGO ROENTGEN SOCIETY

At a recent meeting of the Chicago Roentgen Society the following officers were elected for the year 1951–1952: *President*, Dr. Frank L. Hussey; *Vice-President*, Dr. Roger A. Harvey; *Secretary-Treasurer*, Dr. Benjamin D. Braun.

FLORIDA RADIOLOGICAL SOCIETY

At the annual Spring meeting of the Florida Radiological Society, the following were elected to office for the year 1951–1952; *President*, Dr. John J. McGuire; *Vice-President*, Dr. Thos. H. Lipscomb; *Secretary-Treasurer*, Dr. Nelson T. Pearson.

MISSISSIPPI RADIOLOGICAL SOCIETY

The radiologists of Mississippi after meeting informally for the past several years have organized recently and become incorporated into a society known as The Mississippi Radiological Society. The following are charter members: Dr. W. R. Bethea, Dr. Steve Coley, Dr. Elmer J. Harris, Dr. S. H. Richman, Dr. A. J. McIlwain and Dr. John W. Evans of Jackson; Dr. Thomas B. Dominick and Dr. Fred J. Hamernik of Vicksburg; Dr. Sam Levi of Gulfport; and Dr. Robert H. Peeples of Greenville. The officers are as follows: *President*, Dr. Thomas B. Dominick; *Vice-President* and *President-Elect*, Dr. Sam Levi; *Secretary-Treasurer*, Dr. John W. Evans.

PHILADELPHIA ROENTGEN RAY SOCIETY

At a recent meeting of the Philadelphia Roentgen Ray Society, the following officers were elected for the year 1951–1952: *President*, Dr. Arthur Finkelstein; *Vice-President*, Dr. Theodore Eberhard; *Secretary*, Dr. George P. Keefer; *Treasurer*, Dr. D. Alan Sampson.

RADIOLOGICAL SECTION OF THE BALTIMORE CITY MEDICAL SOCIETY

At a recent meeting of the Radiological Section of the Baltimore City Medical Society the following officers were elected for 1951–1952: *President*, J. Howard Franz, M.D.; *Secretary-Treasurer*, Richard B. Hanchett, M.D. Meetings are held the third Tuesday of each month, September through May.

SOUTH BAY RADIOLOGICAL SOCIETY

The South Bay Radiological Society is a very active group of twenty-four regularly attending radiologists. Meetings are held on the second Tuesday of every month in the homes or offices of the various members. This is an extremely active and stimulating group. Visitors are always welcome. The Secretary of the Society is Dr. Charles E. Duisenberg of Palo Alto, California.

WISCONSIN RADIOLOGICAL SOCIETY

The Second Annual Meeting of the Wisconsin Radiological Society was held on Saturday, May 19, 1951, at the Edgewater Hotel in Madison, Wisconsin. The following officers were elected for the ensuing year: *President*, Dr. Ernst A. Pohle, Madison; *President-Elect*, Dr. John Armbruster, Milwaukee; *Secretary-Treasurer*, Dr. Irving I. Cowan, Milwaukee; *Member of Board of Directors*, Dr. P. W. Snowden, Monroe.

OAK RIDGE SUMMER SYMPOSIUM

The program for the 1951 Oak Ridge Summer Symposium on "The Role of Engineering in Nuclear Energy Development" has been completed. The symposium will be held at Oak Ridge from August 27 to September 7, 1951, with Labor Day a holiday. This will be the third annual Oak Ridge Summer Symposium sponsored by the Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies. The first two symposia were in physics and chemistry, respectively.

The symposium this year is being devoted to engineering at the request of the American Society for Engineering Education. Sessions will be unclassified in nature and will be held in the downtown portion of Oak Ridge. They are open to all interested professional engineers and others.

Information concerning the symposium may be obtained from the University Relations Division, Oak Ridge Institute of Nuclear Studies, P.O. Box 117, Oak Ridge, Tennessee.

INTERNATIONAL CONGRESS OF RADIOLOGY

A limited number of reprints of the Recommendations of the International Commission on Radiological Protection and of the International Commission on Radiological Units, both of which were revised during the Sixth International Congress of Radiology, London, 1950, are available at the Congress Office in London. Applications should be addressed to the Secretary-General, Sixth International Congress of Radiology, 45 Lincoln's Inn Fields, London W.C.2, England.

J. W. McLAREN, *Secretary General*

FELLOWSHIP IN PEDIATRIC ROENTGENOLOGY

Dr. Ji-toong Ling of Norfolk, Virginia, has been awarded the Fellowship in Pediatric Roentgenology in the Children's Hospital of Cincinnati. He will begin his studies on July 1, 1951.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

Pediatric X-Ray Diagnosis. A Textbook for Students and Practitioners of Pediatrics, Surgery and Radiology. By John Caffey, A.B., M.D., Professor of Clinical Pediatrics, College of Physicians and Surgeons, Columbia University; Attending Pediatrician and Roentgenologist, Babies Hospital and Vanderbilt Clinic, New York City; etc. Second edition. Cloth. Price, $22.50. Pp. 862, with 1,039 illustrations. Year Book Publishers, Inc., 200 East Illinois Street, Chicago, Illinois, 1950.

When Dr. Caffey's Pediatric X-ray Diagnosis was published in 1945, it filled a long standing need for a reference book for both radiologists and pediatricians. The new second edition greatly enhances its value. The text contains much new matter, the book has a new format, the pages having two columns which permits the inclusion of additions and changes. The illustrative material has been enlarged by 385 new figures containing 734 new images. Several sections have been rewritten entirely or in large part. Many new references have been added. In the preface, Caffey states that he has attempted to save intact the primary aims of the first edition, namely, description and picture of normal and morbid tissues and the proper evaluation of such shadows in clinical diagnosis. In this he has succeeded. Normal structures and their normal variants have again been stressed. The illustrations of the roentgenograms are clear and line drawings are used profusely to illustrate anatomical findings.

The book is divided as in the previous edition into six sections. The new subjects added are well worth enumerating: prenatal depression of the skull, external deformities of the thoracic wall, internal surface of the thoracic wall, fetal aspiration and ingestion, pulmonary arteriovenous fistulas, pulmonary reaction to chemical poisons, chylothorax, pulmonary histoplasmosis, meconium ileus, meconium peritonitis, barium peritonitis, new tables for skeletal maturation, cortical defects in tubular bones, nutrient foramen for the distal femoral epiphysis, bicipital groove of the humerus, prenatal bowing of the long bones, Ellis-Crevald syndrome, Pyle's disease, Engelmann's disease, infantile cortical hyperostosis and hypervitaminosis A.

The book throughout reflects the author's extensive experience in pediatric roentgenology and his wide knowledge of the pediatric and roentgenologic literature. Much has been gained by the rewritten and enlarged sections and all noteworthy developments and advances in recent literature are now at hand for the radiologist's reference and study. The book should be included in the library of every radiologist. As stated in the review of the first edition, it is a godsend for the radiologist whose pediatric practice is limited.

R. S. Bromer, M.D.

Determination of Physical Factors Influencing the Quality of the Radiographic Image. (The Reproduction Number Method and Its Application.) *Acta radiologica*, Supplementum LXXVI. By Arne Nelson. Paper. Price, Swed. Crowns 15:–. Pp. 87, with 24 illustrations. Esselte Aktiebolag, Stockholm, Sweden, 1949.

Arne Nelson, working at the Fluorographic Center of the Swedish Medical Board in Stockholm, needed a test object for determining the effect of various physical factors on chest microfilms and after consulting the literature decided to make his own. The nature of his test object and the results of his work with it over the period 1946 to 1949 are the subject of this monograph.

The test object is a plexiglass plate 9.6 mm. thick and approximately 13 cm. wide and 18 cm. long. By means of a milling machine, five parallel steps are milled into the surface of the plate, the thickness of the steps decreasing logarithmically from 9.6 mm. for the thickest one to 0.3 mm. for the thinnest. Each of these steps is perforated with 13 holes graduated from 7.8 mm. for the largest to 0.5 mm. for the smallest; and the holes are inclined so that their theoretical axes all meet at a point 80 cm. above the center of the plate (80 cm. happens to be the target-screen distance commonly used in Sweden for photofluorography). When

the plate alone is placed on a piece of roentgen film and an exposure is made at a target-film distance of 80 cm. and with such factors as focal spot size, voltage, current, exposure time, etc., within certain limits, all 78 of the holes show in the completed roentgenogram. Nelson says of such a film that its reproduction number, designated R.N., is 78. Interposing additional slabs of plexiglass to simulate body tissue reduces the number of holes that can be seen in the roentgenogram and therefore reduces its R.N. number. In photofluorographs the imperfections of the optical system and the limitations of the photofluorographic screen reduce the R.N. number.

Although designed primarily for testing the over-all resolving power of photofluorographic apparatus, Nelson finds that his test block is useful also in direct roentgenography.

Many of the pages of the monograph are devoted to curves and charts illustrating how the ability of the roentgenographic or photofluorographic film to record the holes in the plexiglass block is modified by such factors as tube voltage, object thickness, screen quality, focal spot size, processing methods, and so forth.

Paul C. Hodges, M.D.

Surgery of the Shoulder. By Anthony F. DePalma, M.D., James Edwards Professor of Orthopedic Surgery and Head of the Department, Jefferson Medical College, Philadelphia; Attending Orthopedic Surgeon, Jefferson Medical College Hospital, Philadelphia; Attending Orthopedic Surgeon, Methodist Episcopal Hospital, Philadelphia; Attending Orthopedic Surgeon, St. Agnes Hospital, Philadelphia. Cloth. Price, $17.50. Pp. 424, with 445 illustrations. J. B. Lippincott Company, 227–231 South Sixth Street, Philadelphia 5, Pennsylvania, 1950.

Dr. DePalma has written a very authoritative treatise on the surgery of the shoulder. It is a thorough and interesting discussion of the shoulder in all its various aspects from the embryology and anatomical variations to the clinical problems and surgical techniques. His special interest in the lesions of the musculotendinous cuff and the degenerative lesions makes this portion of the work particularly good. The author covers everything in each lesion thoroughly.

The material will be of interest to every branch of medicine, but particularly to the surgeon, the pathologist, and the radiologist.

The book is well illustrated and the printing and general format are well done. Both the author and the publishers are to be complimented on this new volume.

Paul C. Swenson, M.D.

The Esophagus and Pharynx in Action. A Study of Structure in Relation to Function. By William Lerche, M.D., Fellow, American College of Surgeons; Founder Member and Honorary Member of the American Association for Thoracic Surgery; Formerly, Associate Professor of Surgery, University of Minnesota, Minneapolis, Minnesota. Cloth. Price, $5.50. Pp. 222, with 93 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

According to the author, the original purpose of this work was to throw light on the closing mechanism of the cardia. When that purpose was attained his research was continued to include the esophagus from the cardia to the pharynx during the acts of deglutition and regurgitation. Most of his studies were made from anatomical material that had survived in the state of contraction in which they had been active during a phase of regurgitation of stomach contents. The manner of conveyance of regurgitated material from the cardia to the pharynx was studied from specimens which showed markings characteristic of regurgitation. The relation of structure to normal and abnormal function was also investigated.

From the study of the musculature and the mucosa in the region of the cardia in specimens in the state of relaxation and also of those in a state of contraction, the author has become convinced that the closing mechanism at the cardia is the "constrictor cardiae," discovered by Helvetius more than two centuries ago.

The book is arranged in twelve chapters. The anatomy of the esophagus is described and is related to the physiology of deglutition. Consideration is given to variations from the normal physiologic processes and their relation to abnormal anatomical findings and disease processes. Illustrations consisting of photographs of anatomical specimens and of drawings from roentgenograms are scattered throughout the text. The bibliography contains 226 references and affords ample material for further study

and for information on controversial points. The index includes authors and subjects in separate sections.

The descriptions of the anatomical specimens are given in a very detailed fashion and reflect the painstaking study of the author. The book is a most useful and informative volume for the library of roentgenologists and all clinicians interested in gastroenterology.

R. S. Bromer, M.D.

Praktische Elektrokardiographie. Extremitäten-EKG, Brustwand-EKG, Belastungs-EKG. Von Kranz Kienle, Dr. med. habil., Dr. phil., Dozent für Innere Medizin, Chefarzt der II. Med. Klinik der Städtischen Krankenanstalten Karlsruhe. Third edition. Cloth. Price, DM 38.–. Pp. 448, with 426 illustrations. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart O, Germany, 1950.

This book on electrocardiography presents the subject largely from the descriptive standpoint with little reference to basic electrical phenomena involved. Much space is devoted to changes in various features of the tracings as they relate to particular diseases and the specificity of certain alterations, such as depression of the RS-T segment, is overemphasized. Many of the electrocardiograms are presented with clinical data on the patient from whom they were obtained, and in a number of instances serial tracings showing the effect of exercise, drugs, metabolic changes, and the progress of the disease are provided.

Precordial leads are discussed only in the last part of the book, and the role that these, and other special leads, should play in clinical electrocardiography is not adequately presented. One is impressed by the large amount of space devoted to discussion of alterations in the RS-T segment and the T wave, but is surprised to find so little information relating to abnormalities of the QRS complex. The author feels that electrocardiograms taken after exercise have considerable value in a number of different circumstances, and a section of some length is devoted to this matter. Most cardiologists in this country would probably agree that too much attention has been paid to this subject, but a number of interesting ideas are presented.

Franklin D. Johnston, M.D.

Proceedings of the First Clinical ACTH Conference. Edited by John R. Mote, M.D., Medical Director, Armour Laboratories. Cloth. Price, $5.50. Pp. 624, with 414 illustrations. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pennsylvania, 1950.

This monograph consists of fifty-two articles presented before the First Clinical ACTH Conference held in Chicago in October, 1949, under the auspices of Armour and Company. A majority of the papers presented are preliminary reports on the effects of ACTH in many diverse disease states, as well as observations on the alterations it produces in the normal body functions, such as the metabolism of carbohydrate and protein. The effects of this preparation are reported in normal persons; in patients with endocrine disorders of all types; in those with collagen diseases, including rheumatoid arthritis, disseminated lupus erythematosus, and many others; in neoplastic states; in allergic conditions; in muscle and demyelinating diseases such as parkinsonism and progressive muscular dystrophy; and a miscellaneous group which includes, among others, gout, nephritis, cirrhosis of the liver, and hemolytic anemias. The reports are based on studies made on a total of 613 normal persons and patients observed over a period of three years.

The papers must necessarily be considered to be based on investigations in progress, and hence in most instances the opinions expressed are tentative. It is admitted by all that the remarkable actions of ACTH and Cortisone will require extensive additional studies before definitive conclusions can be reached and further speculation is justified.

New information is being accumulated so rapidly in this field that publications such as this monograph, which is less than a year old, are necessarily incomplete. Nevertheless, this collection of reports is probably the most satisfactory starting point for one to familiarize himself with these epoch making advances in medicine.

Cyrus C. Sturgis, M.D.

Cancer of the Breast. A Clinical Study of 1042 Cases Treated at Radiumhemmet, 1936–1941. *Acta radiologica*, Supplementum LXXVII. By Bengt A. Nohrman. Paper. Price, Swed. Crowns, 15:– net. Pp. 98, with

64 tables. Esselte Aktiebolag, Stockholm, Sweden, 1949.

The material reported in this monograph includes 1,042 patients from some 55 hospitals of which 997 received some form of treatment at the Radiumhemmet. Special attention is devoted to a consideration of the importance of intercurrent diseases, a sanguineous discharge from the nipple, heredity and some eight factors believed to influence the prognosis following treatment.

Radical surgery is considered to be the most important therapeutic procedure, when it can be done, and the method of determining operability is very simple. All cases are considered operable in which the tumor and axillary metastases are free from the thoracic wall and no metastases can be made out beyond the axilla. The classification of operable cases is also simple since they are divided into two groups. Stage I includes all cases in which no microscopically proved cancer can be found in the axillary lymph nodes and Stage II includes all those in which cancer can be demonstrated in the nodes.

Although some of the patients received only postoperative radiation therapy the plan of administering both preoperative and postoperative irradiation described by Berven in 1929 was used when possible. With this technique 1,400 to 1,750 r, measured to include backscatter, were given to each of two ports in divided doses about four weeks before the operation and smaller doses were given on three occasions during a period of five months after the operation. If one could accurately estimate the total biological effect of such a prolonged plan it would in all probability fall well below the estimated cancerolytic dose, and the necessity for such a complex procedure seems questionable. That the author shares this opinion seems to be borne out by the fact that inoperable cases were given doses ranging from 2,400 to 2,800 r per field at the first visit.

The statistical survey given at the end of the paper is unusual in that all of the patients were traced. The absolute five year survival rate for the entire 1,042 cases examined was 40.1 per cent and for the 842 cases considered operable 49.5 per cent. The figure for the Stage I mastectomies was 66 per cent and for the Stage II group 41.0 per cent. Only 12.5 per cent of 32 patients treated with irradiation alone were alive at the end of five years and none survived for ten years. A comparison of survival rates showed the combination of preirradiation and postirradiation to have no advantage over postirradiation alone except in the far advanced Stage II cases with periglandular growth surrounding several nodes in the axilla where the five year survival rate was increased from 7.4 per cent to 31.9 per cent by the combined method.

Charles L. Martin, M.D.

Vol. 66, No. 1

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

INDEX TO ABSTRACTS

ROENTGEN DIAGNOSIS

Head

Berrey, B. H.: Postinfantile cortical hyperostosis with subdural hematoma 122
Perotti, B.: "Second disease of Schüller" (referring to osteoporosis circumscripta of the skull) 122
Kay, S., Lees, J. K., and Stout, A. P.: Pituitary chromophobe tumors of the nasal cavity 122
De Simone, F.: Cerebral metastases in lung cancer 122

Neck and Chest

Herdner, R.: Examination of the adult sternum and sternoclavicular joints by planar roentgenography 123
Allison, P. R.: Chest after thoracic operations 123
Johnstone, A. S.: Chest after thoracic operations 123
Willius, F. A.: Origin and evolution of diagnostic procedures with reference to diseases of the heart and circulation 124
Keith, J. D., and Munn, J. D.: Angiocardiography in infants and children 124
Lindemann, B.: Simultaneous angiocardiography and planar roentgenography 124
Franke, H.: Tumors of the heart 124
Miller, G., Becker, I. M., and Taylor, H. K.: Auricular calcification 125
Franke, H.: Anomalies of development and position of the aorta 125
Lodge, T.: Pulmonary manifestations of tuberculosis in children 125
Emery, J. L.: Pulmonary manifestations of tuberculosis in children 126
Macpherson, A. Margaret: Pulmonary manifestations of tuberculosis in children 126
Furcolow, M. L.: Further observations on histoplasmosis 126
Murphy, J. D., and Bornstein, S.: Mucormycosis of the lung 127
Hartweg, H.: Clinical course of Boeck's sarcoid of the lung 127
Dungal, N.: Lung carcinoma in Iceland 128
Reals, W. J., Russum, B. C., and Egan, W. J.: Mesothelioma of the pleura in a child 128

Abdomen

De Andrade, M. A., and De Brito Pereira, L. P.: Spontaneous bilidigestive fistulas .. 128
Piemonte, M.: Cholecystography 128
Buzzi, G.: Case of mobile mid-gastric polyp .. 129
Anex, P.: Two cases of schwannoma of the stomach 129
Panico, F. G., Papanicolaou, G. N., and Cooper, W. A.: Abrasive balloon for exfoliation of gastric cancer cells 129
Lüdin, M.: Early roentgenologic diagnosis of gastric carcinoma 130
Seuc Chiu, A.: Perforating gastroduodenal ulcer 131
Ducuing, J., Pons, H., and Enjalbert, A.: Abdominal aortography 131
Cohen, H. J., Marcus, M., and Sherwin, B.: Retroperitoneal teratoma in infancy 131
Mercer, R. D., *et al.*: Larval ascariasis as a cause of chronic eosinophilia with visceral manifestations 131
Silverman, F. N., and Huang, Nancy: Congenital absence of the abdominal muscles, associated with malformation of the genitourinary and alimentary tracts 132
Michel, M. L., Jr., Knapp, L., and Davidson, A.: Acute intestinal obstruction 132
Lee, C. M., Jr., and MacMillan, B. G.: Rupture of the bowel in the newborn infant 134
Hawkins, C. F., and Hardy, T. L.: On the nature of haustration of the colon 135

Genitourinary System

Wickbom, I.: Influence of the blood pressure in urographic examination 136
Palumbo, L. T.: Horseshoe kidney 136
Howarth, V. S.: Renal hydatid disease 136
Reay, E. R., and Rolleston, G. L.: Diagnosis of hydatid cyst of the kidney 136
Shackman, R.: Sarcoma botryoides of the genital tract in female children 137
Nesbit, R. M., and Baum, W. C.: Endocrine control of prostatic carcinoma 137

Nervous System

Wild, H., and Lehmann, I.: Experiences with pantopaque myelography 137
Matson, D. D., *et al.*: Diastematomyelia (congenital clefts of the spinal cord) 138

SKELETAL SYSTEM

JACOBSON, W. E.: Pseudocystic disease of bone 138

NATHANSON, L., and SLOBODKIN, M.: Acromioclavicular changes in primary and secondary hyperparathyroidism 139

KESSEL, A. W. L.: Arthrography of the shoulder-joint 139

PHILLIPS, J. M.: New bone formation associated with direct extension from lymph node metastases to bone in infiltrating carcinoma of the bladder 139

McKEEVER, F. M.: Fractures of tarsal and metatarsal bones 139

MILCH, H.: Partial scapulectomy for snapping of the scapula 140

BRODSKY, A. E.: Synovial osteochondromatosis of the shoulder 140

THOMPSON, F. R., and WINANT, E. M.: Unusual fracture-subluxations of the shoulder joint 141

WAUGH, R. L., and SULLIVAN, R. F.: Anomalies of the carpus with particular reference to the bipartite scaphoid (navicular) 141

LINDBLOM, K., and HULTQVIST, G.: Absorption of protruded disc tissue 141

ROWE, G. G., and ROCHE, M. B.: Lumbar neural arch 141

BARNETSON, J.: Osseous changes in neural leprosy 142

SEVERIN, E.: Congenital dislocation of the hip 142

MASSIE, W. K., and HOWORTH, M. B.: Congenital dislocation of the hip 142

HART, V. L.: Congenital dislocation of the hip in the newborn and in early post-natal life 143

MILLER, L. F.: Bilateral stress fracture of the neck of the femur 143

STREET, D. M.: Medullary nailing of the femur 144

CAVE, E. F., and ROWE, C. R.: Patella 144

SIFFERT, R. S., and ARKIN, A. M.: Post-traumatic aseptic necrosis of the distal tibial epiphysis 144

KITE, J. H.: Congenital metatarsus varus 145

MINER, I. E.: Sarcoma in Paget's disease of bone 145

JAFFE, H. L.: Aneurysmal bone cyst 145

HALDEMAN, K. O.: Factors determining the deposition and demineralization of bone 145

ORLANDINI, I.: Contribution on the study of early congenital osteogenesis imperfecta 146

RIVEROS, M., CODAS THOMPSON, Q., and BOGGINO, J.: Clinical, roentgenologic and histopathologic discussion of familial polyostotic osteodystrophy 146

FACCINI, M.: Roentgenological appearance of joint alternations in late congenital syphilis 146

DI RIENZO, S.: Spondylitis in brucellosis 147

BLOOD AND LYMPH SYSTEM

LOMMEL, F.: Myeloblastic leukemia 147

RUBINSTEIN, M. A.: Technic and diagnostic value of aspiration of bone marrow from the iliac crest 148

MAZZEI, E. S., *et al.*: Chronic aorto-iliac thrombosis (Leriche's syndrome) 148

KINMONTH, J. B.: Arteriosclerosis 149

GENERAL

SOSMAN, M. C.: Specificity and reliability of roentgenographic diagnosis 149

FREEMAN, J. T.: Ehlers-Danlos syndrome 150

GORDON, S.: Melanotic sarcoma 150

PIRKEY, E. L., REED, E. S., and SMITH, W. H.: Clinical studies of the use of emulsion of ethyl iodophenylundecylate (pantopaque) 150

BOECKER, W.: Feathery appearance of muscle in progressive muscular dystrophy as demonstrated roentgenologically 150

STERLING, K.: Erythema nodosum with tuberculin-neutralizing serum 150

HOWLES, J. K.: Sarcoidosis in the Negro 151

WARTHIN, T. A., COOPER, J. F., and CAPUTI, A. P.: Clubbing of digits, metaplasia of urinary bladder and mucous diarrhea 151

RADIATION THERAPY

WHIPPLE, A. O.: Radical surgery in the treatment of cancer 151

COLLINS, V. P., and Pool, J. L.: Treatment of antral cancer by combined surgery and radium therapy 152

SCHULZ, M. D.: Supervoltage roentgen therapy in cancer of the mouth and throat 152

MARTIN, C. L.: Treatment of cervical lymph node metastases with irradiation alone 153

EBERHARD, T. P., and LEAMING, R. H.: Treatment of carcinoma of the nasopharynx by irradiation 153

WILKINS, G. C.: Carcinoma of the cervix 154

DONALDSON, M.: Future in the treatment of carcinoma of the cervix 154

JOHNSON, W. O., and WEINFURTNER, B. J.: Carcinoma of the cervix associated with pregnancy 154

ELLIS, F., *et al.*: Discussion on the chemical factors modifying radiotherapeutic response 155

MILLER, C. P., HAMMOND, CAROLYN, W., and TOMPKINS, MARIANNE: Reduction of mortality from x-radiation by treatment with antibiotics 155

NITTINGER, DORA.: Results from radiation therapy of hypophyseal tumors 156

Boden, G.: Radiation myelitis of the brain-stem 156
Vannfält, K. A.: Roentgen treatment of bronchial asthma 157
Lumb, G.: Changes in carcinoma of the breast following irradiation 157
Fugazzola, F.: Radiotherapy of menometrorrhagia in puberty and in the child-bearing period 157
Orlandini, I.: Ten year survey of the results of roentgen therapy in tuberculosis of the female genitalia treated at the Institute of Radiology of the University of Parma 158
Czech, H., Kepp, R. K., and Wolthaus, G.: Results of treatment of malignant genital tumors in the Gynecologic Clinic of the University at Göttingen from 1937–1944 158
Heinke, E.: Radium treatment of papillomatosis of the male urethra 159
Fuentes Ferrer, J. J.: Sarcoma of the penis. 159
McWhirter, R.: Adnexal tumours 159
Johnson, R. E., and Ackerman, L. V.: Epidermoid carcinoma of the hand 160
Wiley, H. M., and Sugarbaker, E. D.: Roentgenotherapeutic changes in the small intestine 160

RADIOISOTOPES

Levi, J. E., and Lewison, E. F.: Venous velocity in the leg measured with radioactive sodium 161
Lawrence, J. H., and Wasserman, L. R.: Multiple myeloma 161
Burstone, M. S.: Effect of radioactive phosphorus upon the development of the teeth and mandibular joint of the mouse 162
Kearns, J. E., and Hutson, W. F.: Radioactive iodine in the treatment of hyperthyroidism 162
Oddie, T. H., and Scott, R. K.: Results of uptake and excretion tests with radioiodine 162
Weinberg, S. J., *et al.*: Metastatic adenocarcinoma of the thyroid with elevated basal metabolism 162
McCullagh, E. P., Gold, A., and McKendry, J. B. R.: Radioactive iodine uptake in the hypermetabolism of acromegaly 163
Bohr, H., and Sørensen, A. H.: Study of fracture healing by means of radio-active tracers 163
Twombly, G. H., and Schoenewaldt, E. F.: Metabolism of radioactive dibromoestrone in man 163
Wainwright, W. W., and Lemoine, F. A.: Rapid diffuse penetration of intact enamel and dentin by carbon^{14}-labeled urea 163
Gray, S. J., and Sterling, K.: Determination of circulating red cell volume by radioactive chromium 163
Coliez, R.: Use of cobalt 60 in radium therapy 164
Freundlich, H. F., Haybittle, J. L., and Quick, R. S.: Radio-iridium teletherapy 164

CHEMOTHERAPY

García López, G., *et al.*: Clinical trial with ACTH and cortisone 164
Stickney, J. M., Heck, F. J., and Watkins, C. H.: Cortisone and ACTH in the management of leukemia and lymphoblastoma 165
Spies, T. D., *et al.*: Response to adrenocorticotropic hormone and cortisone in persons with carcinoma, leukaemia, and lymphosarcoma 165
Swan, M. M., and Zelman, S.: Myelokentric acid in the treatment of acute lymphoblastic leukemia 165
Gardini, G. F., and Tori, G.: Clinical experience with nitrogen mustard 165
Goldeck, H.: Use of stilbamidine in generalized plasmocytoma 166

MISCELLANEOUS

Morgan, R. H.: New trends in radiographic screening technics utilizing Schmidt optical systems and high-speed development 166
Rawlins, F. I. G.: Intensification of the flourescent image in radiology 166
Levene, G., and Parkins, C. B.: New type of x-ray cassette cabinet 166
Fitzgerald, G. M.: Dental roentgenography. IV. Voltage factor (kv.p.) 166
Adolph, W., and Taplin, G. V.: Use of micropulverized barium sulfate in x-ray diagnosis 167
Muller, H. J.: Radiation damage to the genetic material. Part II. Effects manifested mainly in the exposed individuals 167
Scott, K. G., and Stone, R. S.: Tumor-host studies. II. Increased concentration of tagged iodotyrosines in the gastrointestinal tract of rats bearing tumors 169
Kemler, R. L., and Graham, E. A.: Studies on the influence of sex hormones on successful heterologous transplantation of human bronchogenic carcinoma 169
Bloom, Margaret A.: Acquired radioresistance of the crypt epithelium of the duodenum 169
Nachlas, I. W., and Borden, J. N.: Experimentals coliosis—the role of the epiphysis 170
Rugh, R.: Effect of x-radiation on squid larval tropisms 170

ROENTGEN DIAGNOSIS

Head

Berrey, B. H. Postinfantile cortical hyperostosis with subdural hematoma; report of a case and review of the literature. *Pediatrics*, July, 1950, *6*, 78–85.

The authors report the case of a twenty-nine month old infant who had a previous history of frequent sore throats with fever. Vitamin administration had been excessive. On admission, the child complained of shoulder pain, limp, swollen tender feet, irritability, fever, and bilateral facial swellings. Roentgenograms showed periosteal thickening of the distal right ulna, both clavicles, the fifth metatarsal bone and one rib. Antibiotics were not effective. Because of extreme irritability and a positive Macewen's sign, trephination was performed and a hematoma discovered under the dura. Improvement was rapid postoperatively.

The authors consider the bone changes in this case to be due to excessive vitamin A administration and postulate that the subdural hematoma was also due to vitamin A toxicity. They summarize the present day theories as to the etiology of cortical hyperostosis in infants as well as the clinical, laboratory and roentgenologic findings. Differential diagnosis and treatment are also mentioned briefly.—*R. M. Harvey, M.D.*

Perotti, Bruno. Sulla "seconda malattia di Schüller" (cosiddetta osteoporosi circoscritta del cranio). ("Second disease of Schüller" [referring to osteoporosis circumscripta of the skull].) *Ann. radiol. diag.*, 1950, *22*, 163–185.

The author reviews the literature on this subject rather thoroughly and presents a good discussion of our present knowledge of this disease. He agrees with many others who have studied osteoporosis circumscripta that it probably represents an early stage of Paget's disease or eventually most cases develop osteitis deformans.

Reported are 2 cases, which the author was able to follow for seven and nine years respectively. The first case was that of a man, forty-five years of age, whose only complaint was severe attacks of headaches. He was treated by deep roentgen therapy over the area of the skull involved. Although he was greatly relieved of this symptom, the skull lesions progressed from a localized decalcified area to extensively woolly involvement of the entire skull. Later, typical changes of Paget's disease were also observed in other bones of the skeleton.

The second patient, a woman forty-eight years of age, likewise had localized decalcified lesions of the skull with primary eburnation of the maxilla. Later the lesions of the skull became multiple and increased in size. A mild degree of platybasia developed. Eventually the entire skull became involved with thickening and spotty opacities of the outer table, typical of Paget's disease. However, no other skeletal lesions were ever observed.

The author advocates deep roentgen therapy to the skull lesions in these patients for relief of symptoms, but with no hope of arresting the disease, which seems to spread and eventually involve the entire skull and usually other bones of the skeleton. *P. E. Russo, M.D.*

Kay, Saul, Lees, James K., and Stout, Arthur Purdy. Pituitary chromophobe tumors of the nasal cavity. *Cancer*, July, 1950, *3*, 695–704.

Although the spread of pituitary chromophobe adenomas into the nasopharynx is not uncommon, the invasion of these tumors into the nasal cavity is rare. Three cases are reviewed, each demonstrating the rare feature of intranasal invasion by the pituitary tumors.

A review of the literature is given, summarizing previously reported cases of chromophobe adenoma with nasal extension.

Two of the cases reported here showed histopathological proof of chromophobe adenoma in the pituitary as well as in the nasal cavity. In the third, the clinical and roentgenographic evidence suggested pituitary origin of the intranasal tumor, although no histopathological corroboration was obtained.

The question arises whether pituitary chromophobe adenomas may assume a malignant character. The conclusion is made that the 3 cases presented here express invasion; however, it is conceded that chromophobe adenomas with metastases may occur. The criteria of malignancy advocated by other authors are discussed.

A fourth case of pituitary chromophobe adenoma that demonstrated nasal extension at necropsy is mentioned; but unlike the other 3 cases, the pathology was not registered clinically.—*J. W. Wilson, M.D.*

De Simone, Francesco. Le metastasi cerebrali nel cancro del polmone. (Cerebral metastases in lung cancer.) *Radiologia*, March-April, 1950, *6*, 233–239.

This article makes the following observations with reference to cerebral metastasis:

1. The brain is a favored site for metastasis especially from lung cancer and other mediastinal malignancies and from cancer of the breast.

2. Cancer of the lung is responsible for 20 per cent of all cerebral metastases and cancer of the breast for 15 per cent.

3. Not infrequently in pulmonary cancer, the first symptoms of disease may be from a cerebral metastasis so that a primary tumor of the brain is erroneously suspected.

In support of these observations and to verify the early hematogenous spread of lung cancer to the brain, the author summarizes his own cases seen at the Department of Radiology of the University of Rome from 1936 to 1949. Of 39 cases, 7 (or 18 per cent) showed cerebral metastasis which always occurred early, usually within four months of the initial pulmonary symptoms. In 2 of these 7 cases, the cerebral symptoms preceded the manifestation of lung disease.—*C. Colangelo, M.D.*

Neck and Chest

Herdner, R. Exploration tomographique du sternum de l'adulte et des articulations sterno-claviculaires; trois cas de tuberculose osteoarticulaire du sternum. (Examination of the adult sternum and sternoclavicular joints by planar roentgenography; three cases of osteo-articular tuberculosis of the sternum.) *J. de radiol. et d'électrol.*, 1949, *30*, 508–513.

This article, with six reproductions of planar roentgenograms of the sternum and sternoclavicular joint, discusses the utility of this method in 3 cases in which the author was able to demonstrate a tuberculous lesion, confirmed by operation, on the inferolateral borders of the sternum. The author points out again the difficulty of getting good conventional roentgenograms of the sternum and the great value that planar roentgenography offers in the study of this structure.—*W. M. Loehr, M.D.*

Allison, P. R. The chest after thoracic operations; surgical aspects. *J. Faculty of Radiologists*, July, 1950, *2*, 1–14.

The author discusses the anatomy of some of the commonly performed chest operations and the roentgenological appearance of the patient afterwards, and the extent to which the roentgen appearance may be affected by further postoperative complications. Lobar or pulmonary collapse after operations may be due to surgical procedure. While vascular thrombosis and embolus may be less directly related, yet they still further complicate the picture.

Operations on the chest wall may be performed for disease of the chest wall itself or for underlying disease of the heart and lungs. Films taken immediately after extrapleural thoracoplasty for tuberculosis may present difficulty. Semb's space bounded behind by the scapula, in front by the pectoralis major and medially by the mediastinum is left by stripping of the lung with the intercostal bundles down toward the hilus, in order to produce vertical and lateral relaxation. After operation this space may be filled with fluid below, air above, and perhaps a lung-containing cavity may be below this. Enough fluid may accumulate in Semb's space to cause kinking and compression of the lower lobe bronchus and so produce collapse. When a pneumothroax is desirable but not possible an extrapleural pneumothorax may be performed. "Pneumonoplasty" is an operation in which lung, parietal pleura and intercostal bundles are stripped down so that when these generate bone again, a second layer of bone is formed over the surface of the lung and this prevents its expanding again.

Operations on the lungs and pleura usually do not lead to such complicated pictures. In postoperative roentgenograms after lung resection, the surgeon is interested mainly in the position of the mediastinum, the amount of fluid, and elevation of the diaphragm and the aeration of the remaining lung. Main complications are bleeding into the space with clot formation and bronchial fistula. The postoperative opacities seen after lobectomy may be very difficult to interpret. They may be due to collections of fluid or blood in the space previously occupied by the lobe or they may be due to a pneumonic process, a hematoma, an infarct, or collapse from bronchial occlusion. Vascular occlusion may be distinguished from bronchial occlusion clinically because sputum is always blood stained and the patient is less ill than with bronchial occlusion.

Operations on the heart may cause a confusing picture in the mediastinum, not capable of roentgenological analysis. Such operations include resection of the pericardium for constrictive pericarditis, closure of the ductus arteriosus and operations devised by Blalock and Potts for pulmonary stenosis.

Local operations on the esophagus do not usually give any characteristic picture. If the stomach is swung up into the chest there may be air and fluid in the stomach, complicating the chest roentgen appearance.—*S. G. Henderson, M.D.*

Johnstone, A. S. The chest after thoracic operations; radiological aspects. *J. Faculty of Radiologists*, July, 1950, *2*, 15–30.

In postoperative radiology the radiologist's ability is dependent upon his knowledge and experience of chest surgery.

A chest film should be taken before the patient leaves the operating room after every operation in which the thorax is opened, in order to show the surgeon that the mediastinum is centrally located and that the lungs are expanded. Thoracic surgery introduces such factors as posture and extrapleural collections of fluid and air to cause mediastinal displacement. In patients who have to lie on one side for a long time the forces of gravity will influence the displacement of fluid, air and anatomical structures. Segmental or lobar atelectasis may be produced in the contralateral lung. A small pleural effusion may collect along the axillary margin of the contralateral side. The heart and mediastinum may be displaced to the contralateral side. The stomach may become distended with gas. In the twenty-four hour film

with the patient sitting up or propped up in bed, one may see either increased translucency or increased opacity. Increased translucency results from extrapulmonary or intrapulmonary (compensatory emphysema or interstitial emphysema) collections of air; removal of organ, with replacement by pneumothorax or herniation of lung or pleura across the mediastinum; removal of soft tissues of the chest wall; introduction of abdominal viscera; gas gangrene.

Increased opacity may be due to collections of fluid or to clot,—either extrapulmonary or intrapulmonary (from inflammatory changes, infarction, edema of cardiac failure, or hematoma); loss of air from atelectasis or incomplete expansion of lung; elevation of diaphragm; introduction of abdominal viscera; dressings on the chest wall.

The author discusses complications following operations on the sympathetic chain in hypertensive cases, and the resections of the esophagus and stomach. After a Smithwick operation on the left side a linear shadow produced by separating fascia in the extrapleural space may be found extending from the middle of the left dome of the diaphragm toward the neck of the 8th rib. After a Smithwick operation on the right side it is common to see a rounded opacity develop several days after the operation, projected into the right cardiophrenic angle in the anteroposterior film, due to an extrapleural hematoma.

After esophagogastrostomy particular interest is taken in free regurgitation into the esophagus. Peptic ulceration and esophagitis are apt to develop immediately above the anastomosis unless large parts of the esophagus and stomach are removed. Regurgitation is most easily demonstrated with the patient supine.—*S. G. Henderson, M.D.*

Willius, Fredrick A. The origin and evolution of diagnostic procedures with reference to diseases of the heart and circulation. VI. Roentgenography of the heart and great vessels. *Proc. Staff Meet., Mayo Clin.*, Aug. 30, 1950, *25*, 514–517.

This report is the sixth in a series on roentgenography of the heart and great vessels. There is a very brief history of the discovery of the roentgen rays followed by the dates and the names of the men who first used this new method in the study of the heart and circulation. The various developments following the original disclosure are briefly reviewed. The roentgenoscope, orthodiagraphy, stereography and teleroentgenography were used before 1908 while oblique and lateral roentgenography and eosphageal shadow were shown by Holzknecht in 1901. The kymograph was introduced by Sabat in 1913. Calcium deposits were first shown in 1921 and opaque visualization of heart and vessels in 1938. An extensive bibliography is appended.—*G. H. Ramsey, M.D.*

Keith, J. D., and Munn, J. D. Angiocardiography in infants and children; new technique. *Pediatrics*, July, 1950, *6*, 20–32.

The increasing use of operative measures to correct congenital and acquired cardiac abnormalities makes any advance in the use of angiocardiography important. The authors have found this diagnostic measure of great aid in infants and children where cardiac catheterization may be difficult or impossible. They decided that more rapid exposures were needed in order to facilitate diagnosis. They have designed an apparatus which permits the taking of four roentgenograms in one second. The apparatus is described in this article and illustrative films are reproduced to show how diagnosis may be facilitated by the securing of multiple rapid exposures following injection of the contrast dye.

The method proved of special value in the study of right to left shunts. Most of their experience has been limited to the cyanotic group of congenital heart lesions. They feel that the procedure is safe but advise against more than one injection of the same contrast medium on the same day.—*R. M. Harvey, M.D.*

Lindemann, B. Simultane Angiocardio-Tomographie. (Simultaneous angiocardiography and planar roentgenography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1950, *73*, 261–267.

The author states that conventional angiocardiography fails often to visualize defects in the septa because of a rapid spread of the contrast substance to all segments of the heart. Simultaneous roentgenography in two planes perpendicular to each other and stereoscopic views attempt to overcome this difficulty.

Sections through different layers of the heart during its opacification with a contrast medium with a single exposure can be obtained in using a planar roentgenographic device by a procedure described by d'Abreu. A special film holder with four roentgen films spaced at 1.4 cm. with intensifying screens arranged in such a way as to compensate for the decrease in intensity of the beam is used. On each film, a different "layer" of the heart is represented, the spacing of the "layers" depending on the distance between the films.

Roentgenograms representing four "layers" of a heart specimen filled with a barium emulsion are reproduced.—*K. E. Matzinger, M.D.*

Franke, Hans. Über Herztumoren. (Tumors of the heart. *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1950, *73*, 299–307.

It may appear simple to divide tumors of the heart into two groups; namely, primary, which are related

to the embryology of the heart, and secondary, which are either due to hematogenous or lymphatic spread, or arise mechanically from the immediate neighborhood of the heart. It seems to be more appropriate, however, to divide the tumors of the heart according to their site; namely, as arising from the pericardium, epicardium, myocardium or endocardium.

According to observation by pathologists, the tumors of the pericardium are fibroma, lipoma, or sarcoma and rarely melanotic sarcoma or carcinoma. Tumors of the myocardium are usually rhabdomyoma or hamartoma. Sarcomas are very rare and are, as a rule, located in the right auricle. Even rarer is angioma of the myocardium or metastatic tumors. Tumors of the endocardium are usually myxomas arising from the parietal endocardium, or from the valves. Cyanosis, dyspnea, and club fingers are the accompanying symptoms.

The diagnosis of a tumor of the heart is very difficult, often impossible. The clinical symptomatology depends upon the location and extent of the tumor. They may be entirely asymptomatic, or may simulate any type of organic heart disease. Disturbances of conductivity are quite common in tumors of the myocardium. Subjectively, patients may complain about oppression, precordial pain, and possibly dyspnea or cyanosis.

Complications may arise from growth and pressure upon surrounding organs. Pericardial effusion occurs quite commonly. Changes in the electrocardiogram depend upon the site of the tumor. The electrocardiogram, however, is usually normal.

Roentgen diagnosis of a tumor of the heart can be made occasionally. The heart may be enlarged, the surface of the heart irregular, and often lobulated. A normal pulsation is usually missing and is quite characteristic of tumor. Kymography, pneumocardiogram, pneumothorax, or bronchographic studies may be helpful. More than 50 per cent of all tumors of the heart lie in the vicinity of the right auricle.

Many conditions must be considered in the differential diagnosis. Cardiac aneurysm, cardiac fat pad, and a loculated pericardial effusion may often simulate a tumor in the vicinity of the base of the heart. An aneurysm of the pulmonary artery, a patent ductus Botalli, aneurysms of the aorta and the coronary arteries should also be considered in the differential diagnosis, particularly in tumors that are located on the left side of the heart. Tumors of the diaphragm, dilatation of the esophagus, abscesses in the vicinity of the spine, atelectatic portions of the lung, particularly in accessory lobes, hyperplasia of the thymus, a substernal goiter, cysts of the trachea and mediastinal tumors, among others, can be mistaken for a primary tumor of the heart.—*H. P. Mueller, M.D.*

Miller, George, Becker, Irvin M., and Taylor, Henry K. Auricular calcification. *Am. Heart J.*, Aug. 1950, *40*, 293–300.

In a ten year period the authors have observed 8 examples of calcification of the left auricular wall, confirmed by postmortem examination in 5 cases. All of the patients had rheumatic heart disease and no history of excessive vitamin D therapy or apparent disturbance of calcium metabolism. Four of the patients were men and 4 were women, their average age being fifty-six years. In the 5 studied by postmortem examination, all showed mitral valve disease, and in addition to calcification in the left auricular endocardium, 3 showed calcific deposition in the mitral annulus, aortic cusp, or mitral cusp. An auricular mural thrombus was present in 4 of the 5 cases.

Roentgenographically auricular calcification is seen in the region of the left auricle as a curvilinear shadow. Distinction must be made from other cardiac calcifications: (1) calcified cardiac valves have a distinctive motion fluoroscopically; (2) calcified coronary arteries are superficial and correspond to the coronary distribution; (3) ventricular calcification generally occurs in the apical region; and (4) pericardial calcification is usually found along the diaphragmatic surface of the heart and anteriorly over the right ventricle.—*Harold Fulton, M.D.*

Franke, Hans. Über Entwicklungs- und Lageanomalien der Aorta. (Anomalies of development and position of the aorta.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1950, *73*, 267–280.

Thirteen different anomalies of development and position of the aorta are described. They are illustrated by routine roentgenograms and schematic drawings. Emphasis is laid on fluoroscopy with the esophagus outlined with barium as a diagnostic aid.

Anomalies of the aorta are relatively common, but produce rarely symptoms consisting of dysphagia, stridor, slight dyspnea and mild cyanosis due to compression of the esophagus and trachea or bronchi.—*K. E. Matzinger, M.D.*

Lodge, Thomas. Pulmonary manifestations of tuberculosis in children; radiological aspects. *J. Faculty of Radiologists*, July, 1950, *2*, 51–59.

Based on a survey of 150 children between the ages of five months and eleven years, the author discusses the roentgenological manifestations of the initial tuberculous infection—the primary lesion. The simplest form of primary infection is the Ghon complex—a small lesion in the lung plus a moderately enlarged lymph node at the corresponding hilus, both of which usually heal in a few months with calcification. The time for calcification to appear varies between three and twelve months or more.

The affected lymph nodes may be hilar or mediastinal or both. The mediastinal lymph node involvement is usually anterior and consequently the esophagus is seldom involved. However, the lymph

nodes are close to the trachea and bronchi. Hence, the lung may undergo collapse due to bronchial obstruction by tuberculous granulation tissue, or due to pressure of, or traction by, a lymph node narrowing the bronchial lumen, or to actual ulceration of a lymph node through the bronchial mucosa.

Occasionally roentgen examination may disclose unilateral or unilobar emphysema. A check-valve effect may be produced in a bronchus by tuberculous granulation tissue or by pressure of a lymph node.

The hilar lymph node enlargement seen in erythema nodosum is very commonly associated with a primary tuberculous infection.

In discussing "epituberculosis of Eliasberg and Neuland," Lodge believes the main cause of such shadows is tissue infiltration by cells and fluid, although he admits that both collapse and consolidation may occur together. The course of this disease is usually benign. The shadow may persist for months while the child is clinically well and then disappear in a few weeks, sometimes leaving no trace, at other times leaving the original underlying focus in varying stages of calcification.

Since the advent of streptomycin the classical snowstorm picture of miliary tuberculosis frequently gives way to a fine almost imperceptible stippling.

The author stresses as the chief differences between childhood and adult type of tuberculosis the role of lymph node enlargement and of tissue reaction in childhood infections, also the rarity of fibrosis in the healing of primary lesions and the comparative absence of cavities.—*S. G. Henderson, M.D.*

Emery, John L. Pulmonary manifestations of tuberculosis in children; pathological aspects. *J. Faculty of Radiologists*, July, 1950, *2*, 60–71.

This paper is concerned with the reactions to the first infection of pulmonary tuberculosis in children and the complications arising from this infection. The lungs account for about 60 per cent of cases of primary tuberculosis coming from (a) infected cows and (b) open adult pulmonary tuberculosis. The organisms gain access probably by inhalation and, producing first a very mild reaction, then spread to the lymphatics, and, travelling in them, to the bronchial and mediastinal lymph nodes, constituting the primary complex. The lobular incidence of the primary complex is listed in percentage as follows: right upper lobe, 33; left upper, 22; right lower, 20; left lower, 18; and right middle, 7. The course of events after the initial infection is either toward healing or progression, depending upon natural resistance, dose, age, coincident infection and nutrition. The usual course taken by the complex is a resolution of the glandular swelling and production of a small scarred area at the site of the primary focus.

The complications from the primary focus are presented diagrammatically. First, the focus may become active and surrounded by a zone of acute inflammatory tissue with no tuberculous spread. Then, the barrier of the focus may be destroyed,—the focus spreading in the interstitial tissue and lymphatics to form a zone of satellite tubercles around the primary focus. At this time the blood stream may be invaded, producing a coincident miliary tuberculosis. With low local tissue resistance, the process may spread through the lung substance as a caseous and necrotic area, perhaps involving a whole lobe or lobule. The infiltrated lobule may soften, produce an abscess, and discharge, infecting other segments of the lung or even resolving. The esophagus, heart and splenic and vagal nerves may be involved in complications arising from mediastinal lymph nodes due to their anatomical location. Perforation of an infected lymph node into a bronchus may lead to widespread pulmonary disease or to tuberculous enteritis.—*S. G. Henderson, M.D.*

Macpherson, A. Margaret. Pulmonary manifestations of tuberculosis in children; clinical aspects. *J. Faculty of Radiologists*, July, 1950, *2*, 72–78.

The chief clinical factors in tuberculosis in children are (a) the importance of a history of contact with open tuberculosis and the effect of this on a young child; (b) the comparative insignificance on the roentgenogram of the pulmonary lesion compared with the lesions in the hilar lymph nodes; (c) the secondary effect of this enlargement possibly causing collapse of the lung; (d) the minimal clinical manifestations compared with the roentgen evidence and the delay in development of symptoms; (e) the usual re-expansion of a collapsed lobe and the final healing of the primary lesion. The author stresses the low rate at which the pulmonary lesions change on roentgenologic examination. It is not often possible to know the exact time at which infection takes place and one negative film is not sufficient to exclude a primary lesion.

Streptomycin has little effect on caseating masses and should not be given at this stage because of the development of a resistant strain of tubercle bacilli which would make ineffective treatment of a subsequently developing tuberculous meningitis. The outlook for acute and subacute miliary tuberculosis and for a tuberculous meningitis has been entirely altered since institution of treatment with streptomycin.—*S. G. Henderson, M.D.*

Furcolow, Michael L. Further observations on histoplasmosis; mycology and bacteriology. *Pub. Health Rep.*, Aug. 4, 1950, *65*, 965–994.

In 1948, Bunnell and Furcolow reported 10 proved cases of histoplasmosis from the Kansas City area. To this series, the author now adds the

clinical records of 6 new patients from whom *H. capsulatum* was recovered. The clinical courses of the previously reported cases are reviewed and brought up to date.

In all 16 cases there was a variation in diagnostic certainty ranging from the clear-cut cases of clinical histoplasmosis, through the probable cases, to those in which the finding of *Histoplasma* was incidental to the diagnosis of another disease. Since the fungus may be found in a variety of clinical conditions, one may question whether it may act as an etiologic agent in some disease processes.

In only 2 of the 16 cases was coexistent tuberculosis and histoplasmosis found, and these 2 were contained in the original report. Of the 6 new cases reported in this paper, 2 have recovered, 1 is still ill, and 3 are dead. One death was due to "heart attack" (no autopsy), generalized histoplasmosis accounted for the second death, while the autopsy diagnosis for the third death was periarteritis nodosa and granulomatosis of unknown etiology.

The changes observed in the lungs on roentgen examination simulate a tuberculous infiltration and in several instances the patients were referred for study because of this possibility. The infiltrations in the lungs vary from small scattered lesions to general granularity of the lungs, miliary infiltrations, disseminated and coalescent infiltrations, and in a few cases cavitation was present. Four of the 16 cases that have recovered have had calcifications appear in hilar nodes and lung parenchyma, with miliary calcifications in 2 of these.

Reproductions of the chest roentgenograms of 12 of the patients are included and are worthy of study.

The fact that almost one-third of the cases covered in this report recovered supports the concept of the occurrence of non-fatal histoplasmosis.—*G. P. Keefer, M.D.*

Murphy, J. D., and Bornstein, S. Mucormycosis of the lung. *Ann. Int. Med.*, Aug., 1950, *33*, 442–453.

Molds are fungi which belong to one of three main groups, the prototypes of which are penicillium, aspergillus, and mucor. Only one mucor infection of the lung has been previously reported in the Western hemisphere.

A forty year old white male farmer was hospitalized in 1947. In 1942 he had been hospitalized in an Army hospital because of pneumonia; a previous induction roentgenogram had been normal. In 1945 he had been hospitalized because of pain in the left chest on coughing; roentgen examination revealed a focus in the left upper lobe, thought to be a tuberculoma. Exploratory thoracotomy was refused.

In 1947 roentgen examination revealed a circular density in the left upper lobe, containing a central core of laminated calcium deposits. Thoracotomy was done and a sharply circumscribed, hard, spherical tumor 4 cm. in diameter removed. The pathologic diagnosis was mucor-mycosis of the lung, which was confirmed by culture.

A left otitis externa had been present for four years, and a culture from this was indistinguishable from the culture of the pulmonary lesion.

The patient was discharged and follow-up revealed that he was in apparently good health three months later.—*A. A. Brewer, M.D.*

Hartweg, H. Über den Verlauf der Boeckschen Erkrankung der Lungen. (The clinical course of Boeck's sarcoid of the lung.) *Deutsche med. Wchnschr.*, Aug. 11, 1950, *75*, 1013–1014.

Boeck's sarcoid of the lungs is being found with increased frequency, as shown by 39 cases discovered in a chest survey of a city of 35,000 by Burger and Kuether, and by Gravesen's personal series of 100 cases. The present series is 66 cases.

Confusion with tuberculosis and fear of the development of tuberculosis does not warrant handling it as tuberculosis from the start. If examined every two or three months, tuberculosis, if it should occur, would be diagnosed early enough.

Dermal sarcoidosis is overemphasized because the original work on the disease was on the skin manifestations, which are relatively uncommon, 2 cases being found in the present series.

The lungs are most frequently, possibly always, involved. Negative chest films may merely indicate that hilar involvement has already occurred and regressed. The increased pulmonary markings of the third stage cannot be distinguished from those of other etiology.

Many observations indicate that the etiological agent enters the bronchial tree, and from the lungs, particularly the hilar regions, spreads by way of the lymphatics and blood stream.

Gravesen showed that the disease starts with a swelling of the hilar lymph glands (first stage), which may completely recede in a period of months or years with no further change. However, during or after the stage of hilar adenopathy, most cases develop a miliary seeding of the lungs (second stage), with lesions of different sizes in different patients, and either generalized or circumscribed in distribution. While the miliary nodules are receding, a hyaline sclerosis of the pulmonary lymphatics produces a radiating network from the hila (third stage).

In about a sixth of the cases the disease does not remain in the third stage of Gravesen. Delicate, rather poorly defined infiltrates, up to the size of a bean, begin to form, mainly in the outer portion of the mid-lung field. The sclerosis of the remainder of the lung goes on, and considerable emphysema results. This stage (fourth), which is called "indurative-infiltrative" can go on to healing, resulting in a typical appearance of star-like forms produced by the shrinking of the individual infiltrates. In the third stage, the connective tissues of the lung are drawn radially to the hilus, while in the fourth

stage they appear to be hung on individual nodules. The patient is still relatively asymptomatic.

In the fifth stage, characterized clinically by progressive dyspnea, loss of weight, and obstinate cough, dense nodules up to 3 or 4 cm. in diameter arise, and then slowly decrease in size with accompanying severe fibrosis of the surrounding lung tissue. The process goes slowly on with new infiltrates in previously healthy lung tissue, diminishing the functional capacity of the lungs until death results. These fatal cases are rare, 2 occurring in the series of 66.

The diagnosis is based upon long observation, a high index of suspicion in reading chest films, and other methods. In the present series, positive lymph node biopsy was present in 16 cases; cystic lesions in bones of hands or feet, without any external abnormality, usually in association with third stage, rarely previously, were found in about one-third of the cases; Heerford's symptom complex (uveoparotid fever) occurred only during the first and second stages in 7 cases; skin lesions in 2; and splenic enlargement in a third case during the process of pulmonary involvement.—*J. J. B. Light, M.D.*

Dungal, Niels. Lung carcinoma in Iceland. *Lancet*, Aug. 12, 1950, *2*, 245–247.

This article is an attempt to explain the discrepancy of the incidence of carcinoma of the lung in Iceland which is 0.6 per cent as compared with the incidence in the United States which is approximately 20 per cent of all carcinomas. The population of Iceland is subject to the same amount of respiratory illness as that of other countries but differs from those nations having a high rate of pulmonary cancer in one fundamental respect. The consumption of tobacco in Iceland has been very much less than in the other civilized countries of the western world until very recently. The author suggests that tobacco smoking over a prolonged period may predispose to carcinoma of the lungs and cites the fact that the rapid increase in incidence in the United States and Great Britain has occurred during the past twenty to thirty years coincident with the beginning of increase in tobacco consumption. He also believes that the difference in incidence between males and females will soon be much less marked as the effect of more widespread smoking among the female population begins to be manifest in time. Lastly, it is felt that within the next twenty years the incidence of carcinoma of the lung in Iceland should rise sharply to equal that in the United States and Great Britain. This last prediction is of considerable interest because it will afford some measure of evaluating the concepts of tobacco and carcinoma of the lung.

This is a very thoughtful article which it would be wise to include in any bibliography dealing with the problem of carcinoma of the lungs.—*R. P. Barden, M.D.*

Reals, William J., Russum, B. Carl, and Egan, William J. Mesothelioma of the pleura in a child. *Am. J. Dis. Child.*, July, 1950, *80*, 85–90.

Mesothelioma of the pleura in children is an uncommon occurrence. The patient, a nineteen month old child, was admitted to the hospital for acute dyspnea following accidental inspiration of two pennies. A roentgenogram of the chest showed the pennies in the upper part of the trachea, with no pulmonary changes or pleural thickening. The pennies were removed and the child was discharged from the hospital on the day following admission. He was readmitted five months later because of cough of six days' duration and irritability and fever of two days' duration. The roentgenograms of the chest showed a completely opaque left pulmonary field. The heart was pushed to the right but the pulmonary field on the right was clear. At autopsy the anatomic diagnosis was primary mesothelioma of the left visceral pleura, with compression atelectasis of the left lung and mediastinal shift to the right.

The authors' patient is the youngest case reported in the literature. They consider the diagnosis as difficult, but bulging of the intercostal spaces, contralateral shift of the mediastinum and rapid reaccumulation of bloody fluid after paracentesis are considered helpful as differential points.—*R. S. Bromer, M.D.*

Abdomen

De Andrade, M. A., and De Brito Pereira, L. P. Fístulas bílio-digestivas espontâneas. (Spontaneous bilidigestive fistulas.) *Rev. brasil de gastroenterol.*, July-Aug., 1950, *2*, 391–404.

The authors describe 5 cases of bilidigestive fistulas which they observed in their own practice: 1 case of hepatoduodenal fistula, 1 case of cholecystogastric fistula and 3 cases of cholecystoduodenal fistulas. A review of the medical literature shows an autopsy frequency of such spontaneous fistulas of about 0.2 per cent. Cholelithiasis is the most important factor in the production of the fistulas. Occasionally the sudden disappearance of a calculus icterus points to spontaneous fistula formation. Roentgenologically, zones of increased translucency (air in the bile ducts) are noted in the region of the fistula but, in general, the roentgen diagnosis is difficult. The patient's history and symptoms are as a rule not pathognomonic.—*E. A. Schmidt, M.D.*

Piemonte, Mauro. In tema di colecistografia. (Cholecystography.) *Radiologia*, March–April, 1950, *6*, 153–189.

In this article, based upon over 350 cholecystograms, the author makes the following observations:

1. Sixty cases which had surgery on the gallbladder, appendix, or duodenal cap permitted a comparison of pathological and cholecystographic findings. Good correlation was obtained between them except in those cases where concentration of the dye was good despite disease of the gallbladder, and in those cases where the gallbladder shadow was faint.

While admitting that a faint gallbladder shadow usually indicates impaired gallbladder function, the author points out that cholecystography cannot discern whether such dysfunction is due to disease primary in the gallbladder, or reflex from lesions located in other organs. Therefore when a faint gallbladder shadow is noted, correlation with all other clinical and laboratory data is necessary before the significance of this finding can be properly evaluated.

Calcified stones indicate infection of the gallbladder added to the underlying gallbladder dysfunction of which bile stasis is a part. Without infection, the stones are non-opaque.

Twenty patients followed for one to four years after initial cholecystography disclosed 2 interesting cases, one showing gradual disappearance of opaque gallbladder calculi, and the other revealing an angioma of the liver with opaque stones in the gallbladder.

2. Cancer of the gallbladder is rare and was found in only 3 cases. A precise diagnosis is rarely possible but is suggested when abnormal findings are present in the gallbladder area such as cholecystoduodenal fistula.

3. The drinking of a glass of water by the patient during cholecystography as a test for gallbladder function is a controversial matter and its value remains to be determined. Two types of response suggest that the procedure has some merit in demonstrating function. In one type, the gallbladder shadow which was initially faint rapidly becomes dense, and in the other, the gallbladder after initially being invisible becomes visible.

Until such time as the complex phenomena governing gallbladder activity are better understood, this procedure cannot be used as a test of function, but in the meantime it serves to supply data pertaining to the function and morphology of the gallbladder and biliary radicles.

The degree and rate of evacuation effected by a fat meal is subject to such variations both within the same individual and from one individual to another that it cannot be used as an index of disease in the gallbladder, stomach, or duodenum.—*C. Colangelo, M.D.*

Buzzi, Germano. Polipo mediogastrico ampiamente mobile. (A case of mobile mid-gastric polyp.) *Radiologia*, March–April, 1950, *6*, 225–232.

The author reports a case of a long, pedunculated, benign gastric polyp arising from the pars media. On the third examination, two years after the first barium study, the polyp was seen for the first time to pass through the pyloric valve into the duodenal cap. Traction as a possible cause for the elongated peduncle was suggested by the presence of three grossly enlarged, linear gastric rugae which arose from the point of origin of the peduncle and converged on the base of the polyp.

Until the extreme mobility of the polyp was demonstrated roentgenographically, the obstructive symptoms of nausea, vomiting and severe abdominal pain had not been attributed to the seemingly fixed polyp. Once revealed as the true cause of the symptoms, surgery was indicated and was performed.

The value of repeated barium meal studies in determining the nature and treatment of such lesions is stressed.—*C. Colangelo, M.D.*

Anex, P. Deux cas de schwannome de l'estomac) (Two cases of schwannoma of the stomach. *Radiol. clin.*, July, 1950, *19*, 206–209.

About 1 per cent of all gastric neoplasms are benign. Schwannoma was first recorded by Lériche in 1911 and its histopathology described by Roussy in 1922. The chief interest to the radiologist lies in the fact that this tumor may easily be confused with an ulcer undergoing carcinomatous degeneration, or an ulcer surrounded by an edematous zone or a polyp.

Commonly two forms of schwannoma are observed in the stomach. The one, on roentgen examination, shows a rounded filling defect which has a regular border, does not alter the mucosal folds or the peristalsis and is most frequently located on the anterior and posterior aspects of the stomach. At times, the barium mixture delineates a niche in the center of the filling defect leading to a typical "rosette niche" appearance. In the other form the roentgen image is not characteristic. Here, too, there is a filling defect but this moves several centimeters during contraction of the organ, indicating that the tumor is pedunculated and that it has a narrow attachment. A study in the horizontal position with the stomach insufflated is of definite value in distinguishing the two varieties of schwannoma and especially in differentiating them from the above-mentioned lesions.

The author during a period of one month observed 2 cases of schwannoma, representing examples of each form. These 2 cases are briefly described and their respective roentgenograms, together with schematic drawings, are reproduced.—*T. Leucutia, M.D.*

Panico, F. G., Papanicolaou, G. N., and Cooper, William A. Abrasive balloon for exfoliation of gastric cancer cells. *J.A.M.A.*, Aug. 12, 1950, *143*, 1308–1311.

In the usual routine aspiration of the stomach most cells have undergone deterioration because of the prolonged action of the digestive juices. Recognition of malignant cells is consequently rendered difficult. This is aggravated by the presence of retained gastric debris.

A method is described by which the stomach is rid of the products of retention and in which freshly exfoliated cells are obtained for study. An abrasive balloon is passed orally after proper preparation of the stomach and is inflated after entering the stomach. The irritation sets up peristalsis, the brush-mucosal contact causing abnormal cells to become attached to the balloon; normal cells are not removed by this procedure.

Four methods are compared using 17 patients with proved malignancy and 16 with benign lesions. (1) The routine smear was made from the aspirated material after a twelve hour fast. In the patients with proved malignant gastric lesions only 4 showed malignant cells and 1 showed suspicious cells. (2) The mechanical irritation smear was made from aspirated material after thirty minutes of irritation of the gastric mucosa by the inflated balloon. Eleven cases showed malignant cells, suspicious cells being noted in 3 cases. (3) The balloon pinch smear was made from the yellow mucosal material selected directly from the brushes after withdrawal. Nine cases showed malignant cells. (4) The balloon wash smear was made from material obtained by washing the entire balloon surface in Ringer's solution. By this method malignant cells were demonstrated in 14 cases, suspicious cells being noted in 1 case; 2 cases wrongly considered negative were shown to be Hodgkin's disease on surgery. The 16 cases of benign lesions tested with the abrasive balloon included ulcers, polyps and gastritis, in none of which was malignancy erroneously diagnosed.

The morphologic detail was best in the balloon pinch and balloon wash methods, there being here the least exposure to the digestive juices. The balloon method, although yet to be perfected, improves the quality and quantity of malignant cells found in a gastric smear and consequently provides a basis for a higher percentage of correct diagnoses.—*J. P. Bennett, M.D.*

Lüdin, M. Die röntgenologische Frühdiagnose des Magenkarzinoms. (Early roentgenologic diagnosis of gastric carcinoma.) *Radiol. clin.*, July, 1950, *19*, 193–205.

This is a report presented before the General Assembly of the Swiss National League for the Fight on Cancer in Geneva on Nov. 27, 1949.

In the introduction the author emphasizes the importance of fluoroscopy in several views for the accurate observation of the peristalsis, the careful study of the mucosal relief, and especially the taking of several spot roentgenograms of the suspected area. An early carcinoma of the stomach can be diagnosed only by a scrupulous technique making use of all available facilities.

The report is subdivided into discussion of the carcinoma (1) of the fornix and cardia, (2) of the corpus and (3) of the prepyloric region of the stomach.

(1) An early diagnosis of the carcinoma of the fornix and cardia of the stomach has lately acquired considerable significance in view of the great improvement made in the operative removal of lesions of this part of the stomach. The author endorses the Jutras technique which permits the direct visualization of the cardia and its close vicinity. In the presence of changes in the folds emerging from the esophagus, an early carcinoma is suspected. A differentiation from varicose veins, however, may be difficult, if not impossible. The author cites 2 patients, 1 having had large varices and the other a beginning carcinoma of the fornix, in both of whom the roentgenograms gave similar filling defects and the exact identification of the lesions could be made only at the operation.

The usually asymptomatic "silent zone" of the upper pole of the stomach constitutes a challenge to the ingenuity of the radiologist. An important diagnostic sign is the thickening of the gastric wall. Porcher suggested pneumoperitoneum as a valuable accessory method for the estimation of the width of the wall of the stomach. However, in most instances CO_2 insufflation of the fornix is sufficient. This is associated with roentgenography in the Trendelenburg position. A stenosis, which often is described as an important clinical sign of carcinoma of the cardia, does not necessarily have to be present, and an esophagoscopic examination may give entirely negative findings. In such instances study of the passage of the barium through the cardia may prove of some aid. A cascade-like passage usually indicates the presence of a tumor underneath the cardia, whereas a tumor located above the cardia is more apt to produce an arc-shaped passage around the lesion when the patient is in a horizontal position, changing to a filling defect when the patient is placed in a Trendelenburg position.

(2) In carcinoma of the mid portion of the stomach study of the peristalsis and mucosal relief by paying special attention to the posterior wall is important. Double or multiple exposure on the same film (polygram) is of aid in case of lack of peristalsis at a suspected site as demonstrated by relief study. Differential diagnosis includes circumscribed, acute edematous gastritis, lymphatic infiltration of the gastric rugae in chronic lymphatic leukemia or lymphosarcoma, etc.

(3) In about 75 per cent of the cases the carcinoma is located in the prepyloric region. It is often extremely difficult to interpret the form changes of this portion of the stomach so that a correct roentgen diagnosis of a prepyloric lesion may constitute

a formidable task. Of the less frequent conditions which may have to be considered in the differential diagnosis are: lues, tuberculosis, actinomycosis, lymphogranuloma, histiomonocytic reticuloma, arborescent lipoma, corrosive scarring and hemangioma.

The significance of partial gastrospasm, certain form changes of the prepyloric region as described by Gutmann (conical form, "forme ondulée") and a few of the pharmacodynamic tests is discussed.

The article is beautifully illustrated with reproductions of typical roentgenograms and of photographs of specimens.—*T. Leucutia, M.D.*

Seuc Chiu, Armando. Úlcera gastroduodenal perforado. (Perforating gastroduodenal ulcer.) *Arch. Hosp. Universitario*, Habana, July–Aug., 1950, *2*, 447–463.

The author notes that gastroduodenal ulcer perforates into the peritoneal cavity in 10 to 15 per cent of cases. Bager in 9,474 cases found 18.1 per cent of perforations and DeBakey in a review of 33,439 cases found 13.2 per cent of perforations. It occurs more frequently in men than in women and much more with duodenal than with gastric ulcer. The author details the clinical symptoms, the physical examination and blood findings, and notes that the most important examination consists of (1) the exploratory roentgenograms made in the erect position, looking for pneumoperitoneum, (2) an exploratory abdominal puncture to determine the presence of free hydrochloric acid in the liquid extracted by the puncture and the absence of germs in the liquid when examined microscopically. The roentgenologic determination of pneumoperitoneum is a very good guide, positive in 70 per cent of cases. The author reports the cases observed in the service of Dr. Roberta Guerra Valdés and Dr. Luis Valdés Larralde in the General Calixto García Hospital, representing 164 days of service in two years. Seventeen cases were operated upon between the ages of twenty-one and eighty-one years. Fourteen of the cases were operated upon during the months of October, November and December. There was a definite previous history in 3 cases. In 11 of the 14 cases pneumoperitoneum was found on roentgen study. Death occurred in 1 patient eighty-one years of age. Every case operated upon within the first twenty-four hours should be saved.—*J. T. Case, M.D.*

Ducuing, J., Pons, H., and Enjalbert, A. L'aortographie abdominale; technique, incidents et accidents, indications, iconographie. (Abdominal aortography; technique, incidents and accidents, indications, images.) *J. de radiol. et d'électrol.*, 1949, *30*, 497–504.

These workers of the Surgical and Cancer Clinic at the Hospital of Toulouse present an excellent article with ten excellent roentgenograms of the injected abdominal aorta reproduced. The technique, instrumentation, and possible accidents with this method are fully discussed. One of the interesting features of this article is a diagram and short discussion of an apparatus of Prof. Christophe of Liège which the authors have used. This apparatus consists essentially of a motor and syringe and piston device which, as the contrast material is injected, permits an automatic operation of the roentgen tube so that the exposure is made at the chosen time to best visualize the injected abdominal aorta. A few of the conditions listed by the authors in which this method is of value are: (1) diagnosis of vascular lesions of the abdominal aorta and its branches; (2) study of the circulation of the abdominal organs, which permits a demonstration of their pathology; (3) study of the circulatory channels into abdominal and pelvic tumors; (4) study of the vascularization of the corpora cavernosa of the penis. It has been shown by Christophe and the present authors that in cases of sexual impotence the corpora cavernosa do not visualize and that the corpora cavernosa are always well visualized by the contrast substance in cases of normal sexual potency. —*W. M. Loehr, M.D.*

Cohen, Harry J., Marcus, Milton, and Sherwin, Benjamin. Retroperitoneal teratoma in infancy. *Am. J. Dis. Child.*, July, 1950, *80*, 75–78.

Retroperitoneal teratomas in infancy are exceedingly rare. A case is reported of a three months old infant, female successfully treated for retroperitoneal teratoma. This is the fifth reported case in infancy and childhood in which treatment was successful. On physical examination a large mass was present in the upper two-thirds of the right side of the abdomen which extended past the midline to the left upper quadrant. A roentgenogram showed a large mass containing numerous calcified areas. The tumor was removed at operation and the pathologic report was teratoma in which several well differentiated organ tissues were present. The case is considered noteworthy by the authors because of the high degree of tissue differentiation present in the pathologic specimen.—*R. S. Bromer, M.D.*

Mercer, Robert D., Lund, H. Z., Bloomfield, Richard A., and Caldwell, Frederic E. Larval ascariasis as a cause of chronic eosinophilia with visceral manifestations. *Am. J. Dis. Child.*, July, 1950, *80*, 46–58.

A case is reported in which the syndrome of chronic eosinophilia and eosinophilic granulomatous lesions of the liver were demonstrated to be caused by the presence within the liver of the larvae of the helminth *A. lumbricoides*. Pulmonary manifestations were also present and were assumed to be of a similar

nature. Roentgenograms of the chest showed infiltration in the upper lobe of the right lung and increased hilar markings with an area of infiltration at the base of the right lung. Follow-up examination after discharge revealed clearing of all pulmonary infiltration but with a persistence of heavy bronchovascular markings in the right hilus extending into the right lower pulmonary field. The right upper pulmonary field had cleared completely.

Allergy to ascaris is thought to play an important part in the production of this clinical entity. However, the authors believe that the liver does not act as a "shock" organ but rather manifests a hyperergic tissue response to the presence of the antigen-producing larvae within it.—*R. S. Bromer, M.D.*

SILVERMAN, FREDERIC N., and HUANG, NANCY. Congenital absence of the abdominal muscles, associated with malformation of the genitourinary and alimentary tracts; report of cases and review of literature. *Am. J. Dis. Child.*, July, 1950, *80*, 91–124.

In this paper the literature on congenital absence of the abdominal muscles associated with anomalies of the genitourinary tract is reviewed and various theories with regard to the pathogenesis of this syndrome are summarized. The authors report 3 cases. The first was a female child, nineteen months of age, who was first seen for symptoms of intestinal obstruction manifested shortly after birth, due to malrotation of the gastrointestinal tract. The patient was treated surgically and during operation the genitourinary tract was carefully examined and no evidence of malformation was found.

The second patient was a male newborn infant with bilateral hydronephrosis, hydroureter and dilatation of the bladder. This patient also had roentgenographic evidence of malrotation of the gut and bilateral cryptorchism.

The third patient was a male newborn child with congenital hydroureter and hypertrophy of the bladder. On exploratory laparotomy, the dilated left ureter was partially resected and the remnants were anastomosed. The patient died of pneumonia shortly after the operation. Necropsy revealed malrotation of the large bowel in addition to the anomaly of the urinary tract.

In their discussion, the authors summarize the following theories of pathogenesis of the common malformation: (1) primary developmental defect of the abdominal muscles; (2) primary genitourinary malformation; secondary changes in abdominal muscles; (3) primary muscular defect and secondary changes in the genitourinary system; (4) intrauterine poliomyelitis; (5) congenital syphilis.

Attention is directed to malformations of the gastrointestinal tract, particularly malrotation, as a previously unrecognized component of the syndrome. In the cases associated with gastrointestinal anomaly the authors state it is impossible to say whether there is any interrelationship between the development of the intestine and that of the abdominal muscles. The occurrence of malrotation is, the authors believe, sufficiently high to warrant investigation of the gastrointestinal tract in all future cases.—*R. S. Bromer, M.D.*

MICHEL, MARSHALL L., JR., KNAPP, LEONARD, and DAVIDSON, ARTHUR. Acute intestinal obstruction; comparative studies of small intestinal and colic obstruction. *Surgery*, July, 1950, *28*, 90–110.

Two hundred fifty-eight cases of acute intestinal obstruction were analyzed because the authors did not consider the results in the treatment of these conditions to be as satisfactory as might be expected. Their study revealed a mortality rate of 16 per cent of patients who had obstruction of the small intestine and 30 per cent of those who had acute obstruction of the colon. They emphasize that these two types of intestinal obstruction differ in so many respects that they should be discussed as two entirely different lesions.

Both types of intestinal obstruction may be either acute or chronic in character, although chronic obstruction of the small bowel is uncommon. The etiologic factors in these two types of obstruction are usually different. Abnormal adhesions and hernias represent the commonest causes of obstruction of the small intestine while primary carcinoma, volvulus, enterocolitis and intussusception comprise the greatest number of obstructing lesions of the colon. Postoperative adhesions are a more frequent cause of obstruction of the small bowel than hernias because of the increased number of abdominal operations being performed and because many industries will not accept workers who have unrepaired hernias and therefore operations are elected before complications occur.

In this series, primary carcinoma of the colon was the cause of obstruction in 62 per cent of the cases. Volvulus of the colon accounted for 20 per cent of the obstructions. Diverticulitis and other inflammatory conditions of the colon caused obstruction in 5 per cent of the cases. Intussusception may cause obstruction in either the large or the small bowel. In this series 8 per cent of obstructions of the small bowel and 15 per cent of obstructions of the large bowel were due to intussusception. Although thrombosis is commoner in vessels supplying the small intestine, it was the etiologic factor in only 1 case of acute obstruction in this series. Other factors included foreign bodies, atresias and internal hernias. In general, obstruction of the colon was commoner in the older age groups than was obstruction of the small bowel. This is particularly true when caused by carcinoma, diverticulitis or volvulus. The average age of patients who had ob-

structions of the colon was fifty-one years and that of those who had obstructions of the small bowel was forty years.

In this series obstruction of the small intestine was approximately five to six times commoner than acute obstruction of the colon. Acute obstructions of the small intestine usually involved the middle and terminal portions of the ileum. The authors feel that this was because the terminal ileum is the most mobile part of the small intestine and has the smallest diameter. It is nearest to the commonest sites of operations on the abdomen and of the external abdominal hernias and is therefore the portion most likely to be involved in adhesions. It is this portion of the ileum that most frequently becomes intussuscepted into the cecum. Acute obstruction of the colon is more likely to involve the sigmoid.

Malignant obstruction of the colon is commoner in the sigmoid and left portion of the colon because in this segment the lumen is smaller and the wall of the bowel is thicker. The fecal content is more solid in the left portion of the colon and this also contributes to the development of obstruction. Volvulus is commoner in this segment because of the long, freely movable mesentery, the relatively short mesenteric root, the proximity of the intestine to the point of fixation and an increase in the length of the intestinal loop. These factors contribute to an excessive mobility of the involved segment. There were 3 instances of volvulus of the cecum, all of which occurred among younger patients. Acute obstruction of the colon owing to diverticulitis almost always involves the sigmoid.

In acute obstruction of the small intestine distention of the bowel usually increases progressively above the site of obstruction, with associated edema, ulceration, inflammatory changes and ischemia of the intestinal wall. "Weeping" of the mucosa takes place and a large amount of fluid may escape into the lumen resulting in an abnormal fluid and electrolyte balance. There may be dehydration, hypochloremia, alkalosis or acidosis, hypoproteinemia, hypovitaminosis, hemoconcentration and azotemia. Acute obstruction of the colon rarely produces extreme changes in fluid balance. An obstructing lesion in the left portion of the colon may, in the presence of a competent ileocecal valve, produce the "closed loop" type of obstruction. There may be great distention of the closed loop, and extensive inflammatory changes, ulceration and focal necrosis may occur. The cecum is the usual site of perforation because this is the thinnest and most distensible portion of the wall of the large bowel.

Strangulation may accompany any type of acute mechanical obstruction, and it is somewhat commoner in the small intestine than in the colon. The mortality rate increases greatly when strangulation causes gangrene of the bowel. This change depends less upon the duration of the obstruction than upon mechanical and pathologic factors. Hernias, volvulus and mesenteric thrombosis are the usual causes of obstruction associated with strangulation of the small bowel. Obstructions with strangulation of a portion of the colon are usually produced by volvulus. The development of obstruction of the colon produced by carcinoma or diverticulitis is insidious, whereas in that associated with volvulus and intussusception the onset is abrupt. The development of obstruction of the small bowel is almost always acute and violent in character. The duration of symptoms is usually longer if the colon is obstructed, and as a rule marked distention of the abdomen is present unless the lesion is in the right portion of the colon. Although nausea and vomiting almost always accompany obstruction of the small bowel they may not be present when the colon is distended. These symptoms may develop slowly if obstruction occurs in the distal portion of the small intestine.

A significant number of the patients in this series either defecated or expelled flatus after the onset of the obstruction. Tenderness to palpation of the abdomen is commoner among patients who have acute obstruction of the colon than those who have obstruction of the small bowel. A palpable, tender mass in the abdomen of a patient who has an acute obstruction of the small bowel almost always signifies that strangulation of a segment of the small bowel has occurred. Hemoconcentration usually accompanies obstruction of the small bowel and it may be marked in advanced cases. Many patients who have obstruction of the colon often have anemia owing to a long-standing disease such as carcinoma or diverticulitis. A moderate degree of leukocytosis is frequently associated with obstruction of the colon but it is unusual with lesions of the small bowel unless strangulation or peritonitis has supervened. The concentration of chlorides in the blood of patients who have an obstruction of the small bowel is frequently decreased, and azotemia may be present. These changes are rarely present in cases of acute colonic obstruction. Hypoproteinemia may be caused by both types of lesions. Alkalosis or acidosis due to extensive loss of fluids may accompany obstructing lesions of the small bowel, but they are uncommon with acute colonic obstructions.

The authors emphasize the importance of the correct interpretation of roentgenograms of the abdomen. Roentgenograms should be made with the patient in both the erect and the supine positions. A series of roentgenograms made at regular intervals of from one to several hours will eventually lead to a definite diagnosis in some cases. Diagnosis should not be delayed, however, because of the possibility of the development of a strangulated intestinal loop. Reproductions of roentgenograms showing examples of obstruction of the small bowel, a "closed loop" obstruction and an obstruction due to volvulus are included in the complete paper. It may be difficult or impossible to determine whether mechanical or

paralytic ileus is present or whether the obstructing lesion involves the colon or the lower portion of the small intestine. The use of the barium enema is urged to localize lesions obstructing the colon. A roentgenogram showing the conical termination of the barium column produced by a sigmoidal volvulus is presented. The authors were able to determine the exact etiologic diagnosis in 90 per cent of the cases in which patients had had acute obstruction of the colon and had had barium enemas. There was no instance of perforation of the colon as a result of its use. They emphasize, however, that barium must never be ingested orally by any patient who has an acute intestinal obstruction.

In general, the mortality rate is higher in cases in which operations have been performed for acute colonic obstructions than for obstructions of the small intestine. Decompression of the proximal portion of the bowel is usually the procedure of choice in the initial treatment of an acute obstruction of the colon. The treatment of obstruction of the small bowel is directed toward three objects: (1) early operative release of the obstruction; (2) replacement therapy for deficiencies of fluids, blood and vitamins; and (3) decompression of the small intestine by intubation. End-to-end anastomosis is preferred to the side-to-side technique. Replacement of fluid and correction of chemical disturbances are emphasized. The use of the Miller-Abbott tube as an adjunct to operative treatment is discussed. It must not be used as a substitute for operative intervention. Occasionally enterostomy is performed for obstructions caused by adhesions that produce too much distention to justify a more extensive procedure. The use of drugs to stimulate peristalsis and of enemas, flushes and purgatives is condemned. Therapeutic, chemotherapeutic and antibiotic agents are used in conjunction with operation. Obstruction of the colon is an indication for immediate, abdominal operation unless it is caused by volvulus of the sigmoid, or it has been definitely determined that gangrene is not present, and proctosigmoidoscopic intubation can produce adequate decompression. The results of the primary resection of colonic lesions compared unfavorably with those obtained for patients who were subjected to a primary operative decompression with subsequent resection of the lesion. Although more difficult from a technical standpoint, the authors feel that a transverse loop colostomy is usually a more satisfactory procedure than primary cecostomy. Transverse colostomy, with or without cecostomy, is the suggested procedure of choice in the treatment of acute obstructing carcinoma of the right portion of the colon.

The authors emphasize that harm may be done by the injudicious use of the Miller-Abbott tube in the treatment of obstructions of the colon because successful intubation may delay operation.—*C. B. Holman, M.D.*

LEE, C. M., JR., and MACMILLAN, B. G. Rupture of the bowel in the newborn infant; including a case report of rupture in the large intestine with recovery. *Surgery*, July 1950, *28*, 48–66.

Rupture of the bowel occurs more frequently in newborn infants than is generally supposed, and it is usually accompanied by an extremely high mortality rate. The authors report the case of the first newborn infant to recover from rupture of the large bowel. This subject was comprehensively reviewed by Abt in 1931 and Thelander in 1939.

The authors state there is considerable doubt that obstetric trauma is ever responsible for rupture of the bowel. Even in the presence of a history of obstetric trauma, if a pre-existing congenital anomaly is sought it will usually be found. Rupture of the bowel can occur in the absence of obstruction, and in such instances, simple closure of the perforation is all that is necessary.

Most cases of perforation are associated with obstruction. The two most common causes of obstruction which lead to perforation of the bowel are atresia and meconium ileus. Congenital atresia may be represented by a diaphragm of the intrinsic bowel tissue which completely obstructs the alimentary tract or by the absence of a segment of bowel with continuity being maintained by only a stringlike residuum that has no lumen. Such complete obstructions are most common in the small bowel but a few such lesions in the colon have been encountered. The perforation is attributed to rupture in a localized area of ischemic necrosis which is produced by the rapidly increasing distention above the point of obstruction. This ischemic necrosis is not comparable to the gangrene that accompanies volvulus or intussusception, because once the rupture occurs and the bowel is deflated, the blood supply may improve and the margins of the perforation may appear perfectly clean except under the closest scrutiny. Perforation usually does not occur unless obstruction is complete and therefore it seldom if ever is due to stenosis of the bowel. Obstruction may also occur when meconium is improperly digested so that it has the characteristics of partially dried glue and will not pass through the intestinal tract. It becomes firmly impacted, usually in the ileum. This condition is seen in patients that have fibrocystic disease of the pancreas. Rupture of the bowel may occur above the level of an obstruction due to meconium ileus but this is not as common as when the obstruction is due to atresia of the bowel.

Volvulus and intussusception may cause obstruction but perforation associated with a gangrenous bowel is considered only incidental to the dominant pathologic process and therefore is not included in this discussion. Obstructions may also be due to congenital constricting bands which may be associated with malrotation of the bowel. In these in-

stances the obstruction is usually incomplete and therefore rupture, if it occurs at all, is extremely rare. Newborn infants with perforation of the bowel appear extremely ill, are cyanotic, and their respirations are rapid and of a grunting character. There is often distention of the abdomen and there may be edema in the flanks, scrotum or vulva. There may be a brawny induration of the edematous area which resembles erysipelas. Anorexia and vomiting occur frequently. The patient may pass some mucus or blood by rectum.

According to the authors the appearance of the roentgenogram of the abdomen is quite characteristic. It demonstrates a massive pneumoperitoneum with diffuse distention of the bowel. They state that contrast studies using barium are contraindicated. A barium enema, however, may be useful in cases in which atresia is suspected because "the tiny undistended colon is virtually diagnostic of complete obstruction higher up whether or not the barium can be made to reach the point of obstruction." The authors express the belief that neither barium nor lipiodol should be used in the presence of a known or suspected perforation. They express the opinion that passage of a stomach tube is of value in ruling out atresia of the esophagus. Its position should be confirmed roentgenologically.

The authors' case is that of a two and a half day old white, male infant who had persistent vomiting and severe abdominal distention. The vomitus, at first bile stained, became "fecal" (meconium) in character. However, five normal meconium stools were said to have been passed. The diagnosis of a ruptured hollow viscus became obvious when roentgenograms of the abdomen which were made in the horizontal, vertical and lateral positions had been obtained. Both intraluminal and extraluminal gas-fluid levels could be demonstrated. Operation was carried out after the patient's condition had become improved owing to restoration of the fluid and electrolyte balances. There was a large perforation of the anterior wall of the cecum, the margins of which were ragged and demonstrated questionable evidence of necrosis. In retrospect, the authors express the belief that this was a typical rupture of the bowel due to ischemia. It was the original impression that the rupture was due to trauma associated with obstetric delivery. The perforation of the cecum was closed by means of transverse sutures after as much meconium as possible had been removed. Cecostomy was not performed.

The following morning a barium enema was cautiously administered to rule out the possibility of atresia. There was a striking narrowing of the entire descending colon on roentgenographic examination and the column of barium apparently stopped abruptly at a point just proximal to the splenic flexure. It was then decided that in spite of the history of the passage of normal meconium stools, there was in fact a congenital atresia at an unusually low level. A second operation was undertaken fourteen hours after the first and an enormously distended small bowel was revealed. Following decompression the point of atresia just proximal to the splenic flexure was easily identified. A short segment of the bowel, including the atretic portion, was excised. Recovery was uneventful following the operation. It was then noted that although the descending colon had increased in diameter the transverse colon remained grossly distended. A short segment, about 4.5 cm. long, just distal to the anastomosis remained markedly narrowed and there was partial obstruction. A tube cecostomy was performed and three days later with the patient under general anesthesia, another abdominal operation was carried out. The narrowed segment was excised and another side-to-side anastomosis was accomplished. Although from a clinical standpoint the patient made an uneventful recovery, subsequent examinations indicated that the colon was not entirely normal when the patient was four months of age. The proximal portion of the colon was markedly dilated and the distal part showed a steady increase in diameter approaching the normal caliber.

This case illustrates that the colon distal to the point of atresia was intrinsically normal and could function well if the normal bowel contents could be made to reach it. It is therefore thought to be unwise for the surgeon to perform an exteriorization procedure simply because the bowel distal to the obstruction is small. The persistence of the narrowed segment which necessitated the second operation was not well understood. The authors suggest three possible explanations: achalasia due to congenital deficiency of the myenteric plexus; inflammatory changes due to sutures which were known to have passed through the intestinal mucosa; and congenital stenosis accompanying the atresia. The authors emphasize the use of the Webb-Wangensteen procedure to determine the distensibility of the collapsed bowel distal to an atretic segment. They also emphasize the importance of resection of the devitalized bowel in patients who have a perforation secondary to meconium ileus. This is accomplished after the bowel has been completely cleared of inspissated meconium by flushing the segment with a saline solution and 5 per cent pancreatin which is injected through an enterostomy tube.

The ultimate outlook is not as favorable for patients with meconium ileus as it is for recovery from an atresia of the bowel, even if the surgical recovery is uncomplicated. This is because the patient still has the pancreatic insufficiency characterized by the so-called celiac syndrome.—*C. B. Holman, M.D.*

Hawkins, C. F., and Hardy, T. L. On the nature of haustration of the colon. *J. Faculty of Radiologists*, July, 1950, *2*, 95–98.

The authors made roentgen studies of the dead colon containing a barium sulfate suspension. They

were able to demonstrate that haustrations due to crescentic folds of mucous membrane hanging in the lumen of the colon were still present, even though the surface was smooth, apart from the occasional sacculations produced by the taeniae being about one-sixth shorter than the colon itself. They point out that the mucosal folds are thin and pointed and the segmentations produced by them are irregular and rectangular. They are seen best in the living by barium enema study. In addition there are muscular haustra. These involve the whole wall and are readily demonstrated by barium meal study. They are produced by the contraction of the circular muscle. The indentations are globular, opposite each other, and often very regular. Successive roentgenological studies of 30 cases of ulcerative colitis confirm the fact that the destruction of the mucosal folds causes an early and permanent disappearance of this type of haustration, whereas muscular haustra may be seen in longstanding cases, though gradually becoming more irregular and distorted. In polyposis the presence of mucosal folds, which are incompatible with a disorganized mucous membrane, suggests that it is of congenital rather than of inflammatory origin.—*S. G. Henderson, M.D.*

Genitourinary System

Wickbom, Ingmar. The influence of the blood pressure in urographic examination. *Acta radiol.*, July-Aug., 1950, *34*, 1–5.

It is well known that urinary discharge into the pelvis of the kidney ceases when the systolic blood pressure falls to a level approximating 70 mm. Hg. When there is a fall in blood pressure, the filling of the renal pelves with the contrast medium during the performance of an intravenous urogram may be incomplete. Thus, in cases in which there is failure of visualization of the renal pelves, it would seem advisable to obtain a blood pressure reading.

The causes of blood pressure fall during intravenous urography are not known and the author intends to do studies along this line. He notes that the phenomenon has been observed in cases which were done under anesthesia so that the anesthetic could have been responsible for the fall. In the cases described in the article it would seem that the hypotension was reflex in origin due to the compression apparatus. The pressure on the aorta probably produced reflex stimulation of the sympathetic nerves.—*Mary Frances Vastine, M.D.*

Palumbo, Louis T. Horseshoe kidney; report of a case with right hydronephrosis and ptosis. *Urol. & Cutan. Rev.*, July, 1950, *54*, 395–398.

This article includes a case report of a patient who had operative correction of a horseshoe kidney with a good result. The author divides the cases of horseshoe kidney into three groups: first, those who have no symptoms and in whom there are no renal pathological changes. These patients are usually discovered to have a horseshoe kidney as the result of routine physical examination or studies of the urinary tract. Second, the patients who have well developed renal pathological changes and symptoms of renal origin. This group includes those patients with hydronephrosis, pyonephrosis, calculi or tuberculosis. Third, those patients who had symptoms associated with horseshoe kidney but with very little renal pathological change other than some dilatation.

The authors point out that the symptoms caused by horseshoe kidney can be relieved and a normal anatomical relation can be restored by division of the renal isthmus and nephropexy on one or both sides. Heminephrectomy should be reserved for those cases in which obstructive calculus, pyonephrosis, tumor or some other complication is present.—*G. W. Chamberlin, M.D.*

Howarth, V. S. Renal hydatid disease. *Brit. J. Surg.*, July, 1950, *38*, 38–43.

Renal hydatid disease is very rare. A registry series of 2,002 cases of hydatid disease included only 44 examples of renal cysts. The author reports 5 cases, none of which were correctly diagnosed before operation. The cyst was calcified in only 1 of these cases and the roentgenological examination does not differentiate between hydatid cysts and other cystic diseases of the kidney and renal neoplasm.—*G. M. Wyatt, M.D.*

Reay, E. R., and Rolleston, G. L. Diagnosis of hydatid cyst of the kidney. *J. Urol.*, July, 1950, *64*, 26–52.

The sources of infestation, means of inoculation and the pathogenesis and histogenesis of hydatid cysts is discussed by the authors. Among the possibilities which may arise following the development of the cyst are: latency, in which the parasite becomes inactive but does not die; formation of daughter cysts; rupture of the cyst; suppuration within the cyst; and general systemic effects from absorption of the proteins in the hydatid fluid. Formation of antibodies in response to the presence of the hydatid antigen form the basis for the complement fixation test, which should be positive in 80 per cent of the cases.

Renal symptoms which may occur with kidney infestation include: mild intermittent pain due to calyceal colic; mild hematuria; lumbar pain due to rupture of a cyst and ureteral colic from passage of hydatid debris.

The survey film of the abdomen will often disclose a rounded area of calcification within the kidney parenchyma. The renal outline is often enlarged and irregular. Pyelography and retrograde urography will show distortion of the renal pelvis or calyces. Commonly the so-called "spider-leg" deformity of a

calyx is demonstrated. In the presence of a pseudo-closed type cyst, the calyx communicates with a potential space producing what the authors describe as a "wine-glass" sign or crescent of dye outlining the cyst cavity.

In the differential diagnosis conditions to be considered are: polycystic disease; malignancy of the kidney; hydro- and pyo-nephrosis; hydatid cysts of the liver; tuberculosis of the kidney; renal carbuncle; renal calculi; and tumors of the spleen and mesentery. The authors consider each of these in turn, citing illustrative cases with film reproductions to illustrate the difficulties of differential diagnosis in hydatid disease of the kidneys.

The importance of securing films of the abdomen in different phases of respiration is emphasized in distinguishing between kidney and liver involvement. —*R. M. Harvey, M.D.*

Shackman, Ralph. Sarcoma botryoides of the genital tract in female children. *Brit. J. Surg.*, July, 1950, *38*, 26–30.

Sarcoma botryoides is a rare, malignant, mesodermal tumor arising from the lower part of the female genital tract. In children, it usually arises from the vagina. Grossly it resembles a bunch of grapes and histopathologically a rhabdomyosarcoma. The author collected 54 cases of such tumors in children from the literature and adds 1 case of his own.

From the literature he concluded that metastases are rare and that the extremely high reported mortality was due to local recurrence. Accordingly, the author's patient, aged four years, was subjected to radical surgery consisting of excision of the vagina, uterus, bladder and urethra, with transplantation of the ureters into the colon. She is living with no evidence of recurrence two years following operation.

No mention is made of roentgen therapy except the statement that it may be anticipated to be unsuccessful.—*G. M. Wyatt, M.D.*

Nesbit, Reed M., and Baum, William C. Endocrine control of prostatic carcinoma; clinical and statistical survey of 1,818 cases. *J.A.M.A.*, Aug. 12, 1950, *143*, 1317–1320.

Data for this study were obtained by pooling collected cases of carcinoma of the prostate from a group of physicians who represented a cross-section of urologic practice in the North American continent. The data were presented on a uniform prescribed printed form. Of the entire series, 947 patients were followed for three years and 607 for five years. A control group of 795 untreated patients was similarly followed.

The paper gives tables and charts showing the survival rates after specified periods of time, grouping the patients as to the form of treatment (diethylstilbestrol, orchiectomy or a combination of both) and as to whether metastases were present or not, comparing the values with those of the control group.

Three and five year survival rates were definitely greater in endocrine controlled patients than in the controls in those cases in which no metastases were present. The value of castration alone and diethylstilbestrol alone appeared to be equal in these cases. A combination of the two forms of therapy, however, provided a greater survival rate than either alone.

In the cases with metastases, treatment with castration and/or estrogen still prolonged life but to a lesser degree than in those without metastases. Estrogen alone appeared less effective than orchiectomy alone. The five year survival rate for those given estrogen alone was only slightly greater than for those in the control group, and yet there were some cases which enjoyed prolonged remissions with estrogen therapy. Orchiectomy alone resulted in approximately the same percentage of five year survivals as the combined therapy. Because of the adverse effect metastases have on the survival rate, even when estrogen or castration therapy is given, it would seem desirable to begin therapy early in the disease—before metastases appear.

In cases where there had been a relapse after the original treatment with either castration or estrogen alone, additional treatment was given with the other form of therapy. Castration and estrogen therapy appeared about equally effective. Symptomatic relief was noted in as high as 36 per cent of the cases. Some of this may, however, have been due to the bed-rest during hospitalization, the increased nutrition with nursing care, etc., as well as to psychological factors. The survival period amounted to an average of only 9.6 months after the onset of relapse.—*J. P. Bennett, M.D*

Nervous System

Wild, H. and Lehmann, I. Erfahrungen mit der Pantopaque-Myelographie. (Experiences with pantopaque myelography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1950, *73*, 213–219.

Pantopaque is used rather than other compounds because its low viscosity permits entry into narrow arachnoid spaces; shortens time of fluoroscopic observation; and it is more easily aspirated. The suboccipital approach is preferred since there is more importance attached to the upper limits of a spinal tumor. One cubic centimeter of the medium suffices for any examination. An effort is made to aspirate the entire amount injected; any remaining portion is removed at time of surgery, planned in advance.

Side-reactions are listed as follows: headaches (7), general malaise (4), caudal neuralgia (4), paresthesia (3), nausea and vomiting (1) and meningism (1). There were 5 cases of hyperpyrexia occurring within the first three days, 5 cases of rectal and bladder

dysfunction, 1 case of arachnoiditis, and exacerbation in several cases of multiple sclerosis and symptoms due to the presence of spinal tumors. Myelography should not be employed unless strictly indicated. The method is advocated even if there is precise neurological localization, especially in suspected compression of the spinal cord or cauda.

The authors demonstrated 7 complete and 3 partial blocks. Unhindered flow of the medium was found in 4 cases: 2, intramedullary tumors; 1, spinal cord changes due to kyphoscoliosis; 1, spinal encephalomyelitis. In the latter case, the differential diagnosis could not be made from spinal tumor clinically or roentgenographically.—*J. Zausner, M.D*

Matson, D. D., Woods, R. P., Campbell, J. B., and Ingraham, F. D. Diastematomyelia (congenital clefts of the spinal cord); diagnosis and surgical treatment. *Pediatrics*, July, 1950, *6*, 98–112.

The term diastematomyelia includes any abnormal cleft or division of the spinal cord or its intraspinal derivatives. The distinguishing feature in the authors' group of cases was the projection of a bony spicule from the posterior surface of a vertebral body through the spinal cord to transfix the spinal cord or cauda equina, usually in the midline. Most of the previous descriptions have been postmortem. The authors report 11 operative cases, in 9 of which the diagnosis was made prior to operation.

The diagnosis is suggested by the presence of a cutaneous defect in the region of the underlying neural abnormality and usually in the midline. Among the cutaneous defects were abnormal tufts of hair, skin dimples, poorly circumscribed masses of fat and port wine angiomas. The presenting complaints varied from muscular imbalance in the lower extremities, gait disturbances, foot deformities, urinary or fecal incontinence to enuresis.

The diagnosis is confirmed on roentgen examination by the demonstration of a bony spicule in the center of an area of spina bifida. There is also usually abnormal widening of the spinal canal at the same level. Myelography confirms the presence of a splitting of the dural canal. The operative correction of the defect is discussed in detail. Early postoperative results have been encouraging.— *R. M. Harvey, M.D.*

Skeletal System

Jacobson, W. E. Pseudocystic disease of bone. *Arch. Int. Med.*, July, 1950, *86*, 35–50.

Pseudocystic disease of bone is suggested as a suitable term for a group of diseases of unknown origin characterized by local or diffuse demineralization of bone. Recently a close relationship between Letterer-Siwe disease, Hand-Christian syndrome, eosinophilic granulomatosis and lipid granulomatosis (xanthomatosis) has been suggested. Fibrous dysplasia of bone may show similar clinical features to the above. Roentgenologically all the lesions in this group of diseases are characterized by what appear to be bone cysts, which may be single or multiple. Histopathologically, the lesions are not true cysts and appear to be proliferative processes of the reticuloendothelial system.

In 1940 Lichtenstein and Jaffe, on the basis of a single lesion occurring in the femur of a four year old girl, proposed the term "eosinophilic granuloma of bone." Independently a similar lesion was described by Otani and Ehrlich. In 1928 Rowland, describing the lesions of the Hand-Christian syndrome, had noted the presence of reticulum cells, histiocytes, foam cells, eosinophils, round cells and polymorphonuclear cells. He considered the foam cell to be the characteristic histologic feature and thus concluded that the lesion was a distinct form of xanthomatosis. There seems little doubt that the eosinophilic and xanthomatous lesions are, at most, different phases of the same disease process.

The first description of osteitis fibrosa cystica was given by von Recklinghausen. It soon became apparent that all cases of osteitis fibrosa cystica were not caused by parathyroid overactivity. The cases of skeletal disease due to parathyroid tumor or hyperplasia were called "osteitis fibrosa cystica generalisata" to differentiate them from cases of other origin, which were called "osteitis fibrosa cystica disseminata." Up to 1942 Lichtenstein and Jaffe collected examples of disseminated osteitis fibrosa described under thirty-three different titles and proposed the term of fibrous dysplasia of bone. Descriptions of the clinical variants and different aspects of the histopathologic picture of fibrous dysplasia have been presented by Albright and his colleagues, Lichtenstein, Jaffe, Snapper and Thannhauser. The disease process may be monostotic or polyostotic. A severe form of the disease is represented by the unusual syndrome described by Albright and his associates. Snapper was the first to report the presence of foam cells in the lesions of osteitis fibrosa disseminata. He considered the disease to be a variant of the Hand-Christian syndrome and concluded that cases of fibrous dysplasia of bone might well be instances of "xanthomatosis without craniohypophyseal localization." Thannhauser suggested the fibrous dysplasia of bone is a variant of neurofibromatosis. In opposition to these views, Albright considered the process to be a distinct and separate entity.

Four cases are presented in an effort to dispel some of the confusion with regard to the interrelationship of the pseudocystic lesions of bone.

The work of Green and Farber in studying bone lesions at various ages in 10 patients led the author to suggest that the eosinophilic granuloma represents the new lesion, the lipid granuloma, the intermediate lesion and fibrous dysplasia the old lesion. In some cases even further changes may occur with cartilaginous or osseous metaplasia. Thus it appears

that eosinophilic granulomatosis, lipid granulomatosis and fibrous dysplasia of bone may be clinically and roentgenologically indistinguishable and dynamically interrelated pathologically.—*A. B. Smith, M.D.*

Nathanson, Louis, and Slobodkin, Morris. Acromioclavicular changes in primary and secondary hyperparathyroidism. *Radiology*, July, 1950, *55*, 30–35.

Acromioclavicular changes are described in 3 cases of hyperparathyroidism of the primary and secondary types. The changes observed were cupping and fraying of the outer end of the clavicle with similar less striking changes in the articular surface of the acromion process. There may be widening of the acromioclavicular joint space. Changes are similar to those seen at epiphyses in vitamin D deficiency rickets.

These changes are absent in senile or postmenopausal osteoporosis and polyostotic fibrous dysplasia, conditions which must be differentiated from hyperparathyroidism.—*E. E. Seedorf, M.D.*

Kessel, A. W. Lipmann. Arthrography of the shoulder-joint. *Proc. Roy. Soc. Med.*, June, 1950, *43*, 418–420.

This paper is a preliminary report based on 25 satisfactory examinations carried out at St. Mary's Hospital, London, during the past two years.

A principal object of the work was to establish the normal anatomy of the shoulder joint as shown by arthrography, and to determine the value of arthrography in the diagnosis of injuries to the musculotendinous cuff. It was hoped that some light might be thrown on the pathology of the "frozen shoulder."

A brief review and analysis of the literature is given.

Technique. The needle is introduced under screen control from a point 1 inch anterior to the acromioclavicular joint until the point is embedded in the articular cartilage of the humeral head. The needle is then slightly withdrawn while pressure is maintained on the plunger of the syringe. A child's lumbar puncture needle is employed. If a needle with too long a bevel is used the dye may be injected into the joint, bursa and related soft tissues at the same time. A total of 8–10 cc. of 35 per cent pyelosil is injected and roentgenograms are made in 6 different views, as recommended by Lindblom. It is probable that the conventional sagittal and coronal views would give the required information.

Conclusions. In each of 3 patients who displayed the "frozen shoulder" syndrome a degree of obliteration of the inferior joint recess was found. At this stage arthrography of the shoulder joint is not recommended as a routine method of investigation.

Reproductions of roentgenograms and a line drawing illustrate normal anatomy and pathological change in several shoulder abnormalities.—*D. R. Bernhardt, M.D.*

Phillips, John M. New bone formation associated with direct extension from lymph node metastases to bone in infiltrating carcinoma of the bladder; report of a case. *Radiology*, July, 1950, *55*, 94–96.

The incidence of direct extension to bone from a primary carcinoma of the bladder or metastatic lymph nodes is unknown, but appears to be uncommon. No mention is made in the reviewed literature of new bone formation from such extension. One case is reported where such new bone formation occurred as radial spicules projecting from the brim of the pelvis on the left into a palpable mass of metastatic lymph nodes of the external iliac group—*M. B. Goodwin, M.D.*

McKeever, Francis M. Fractures of tarsal and metatarsal bones. *Surg., Gynec. & Obst.*, June, 1950, *90*, 735–745.

The prime objective of the treatment of fractures of the bones of the foot is twofold: first, stiffness or loss of flexibility must be minimized; second, bony prominences which will result in pressure from the use of a shoe must be avoided. All too often a perfect roentgenogram is seen but the foot is so rigid that the individual cannot take a step without pain.

All the pathological changes which occur in trauma to the foot result in hemorrhage which leads to the formation of fibrous tissue. The normal flexibility of the foot is interfered with. This is accompanied by demineralization of bone which frequently leads to a syndrome which has been described as "Sudeck's atrophy" or "reflex sympathetic dystrophy." It may be seen that prolonged immobilization of a foot distended with blood is a very common precursor of this disabling syndrome.

In the treatment of a fracture of any individual bone of the foot, the function of the entire foot must be constantly kept in mind. Attention must not be focused on the roentgenogram of a single bone and the rest of the foot and its part in weight bearing ignored.

Fractures of the Astragalus. This bone has a very meager blood supply. A fracture through the neck, as in the femur, may result in avascular necrosis of the proximal fragment. Aseptic necrosis of the body of the astragalus will result in (1) non-union of the fracture, (2) loss of the ankle joint and (3) loss of the subastragalar joint, which constitutes a total disability. If only anatomical replacement is carried out in a displaced fracture of the neck of the astragalus this sequence of events may result. A subastragalar fusion should be carried out initially in this type of fracture.

Minor fractures of the astragalus should be treated

by measures aimed at the absorption of hemorrhage and early protected weight bearing.

Astragalectomy, total or partial, should not be done when there is any possibility of replacement even though comminution is severe.

Fractures of the Tarsal Scaphoid. It is important not to confuse the accessory scaphoid bone (the os tibiale externum) for fracture. This is present in 15–20 per cent of individuals. Sprain fractures should not be immobilized. Treatment of the compression-extrusion type of fracture requires reduction of the extruded fragments and maintenance in the normal position between the head of the astragalus and cuneiform. Reduction is always unstable and extrusion tends to recur. Even with satisfactory reduction, a severe traumatic arthritis of the astragaloscaphoid joint develops.

Fracture of the Cuboid and Cuneiform Bones. Isolated fractures of these bones are rare. When they do occur, reduction is not usually necessary. Ordinarily, immobilization in plaster is contraindicated.

Fracture of the Metatarsals and Phalanges. Injuries to the metatarsal bones may result in great disability. Damage which appears by roentgen study as trivial may lead to severe crippling, and that which appears gross and irreparable on the roentgenogram may cause little or no disability. The danger points in order of their importance are: (1) the distal end of the first metatarsal bone, the metatarsophalangeal joint of the great toe, and the proximal end of the proximal phalanx of this toe; (2) the heads of the second, third, fourth, and fifth metatarsals and the metatarsophalangeal joints of these toes; (3) the articulation of the cuboid bone with the fourth and fifth metatarsals. (One of the most prolonged complaints of any patient following a fracture of the tibia or femur is pain in the foot, which is the result of stiffness from immobilization.)

Contusions, sprains and minor fractures without displacement in this portion of the foot should not be rigidly immobilized for long periods of time. The metatarsal head displaced into the sole of the foot must be corrected and placed in proper alignment with the shaft so that it is not a bony prominence in the anterior arch. Adhesive tape traction is a waste of time in these fractures. If traction is necessary it should be effected by a wire through the distal phalanx or pulp of the toe. Open reduction may be necessary. As soon as possible motion of the toes should be started.

The so-called "tennis fracture" at the tuberosity of the fifth metatarsal is common and it is often overtreated. Generally speaking, this fracture should be treated by measures to absorb hemorrhage such as adhesive strapping and early weight bearing. From the twelfth to the sixteenth years there may be a separate center of ossification or epiphysis on the lateral side of the base of the fifth metatarsal. This has been mistaken for fracture.

Fractures in the shafts of the metatarsals are not, as a rule, a cause of disability unless stiffness of the toes results secondary to them.

The second and third metatarsal shafts can be fractured ("march fracture") without a history of definite trauma. In compound injuries of the metatarsal shafts with loss of substance which appears irreparable, the prognosis is not too discouraging. In severe compound injuries of the forefoot the same attitude should be taken as toward the hand. Every effort should be made to save as much as possible.—*Mary Frances Vastine, M.D.*

Milch, Henry. Partial scapulectomy for snapping of the scapula. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 561–566.

Milch regards the condition of scapular snapping or grating as far from rare. The noise is of varied character. It has been described as a gentle friction sound which must be considered physiological; a somewhat louder sound; a loud snapping noise which is of pathological importance. In general, scapular snapping has been caused by changes in the bone structure, in the muscles or in the bursae. The changes in the bone structure may occur either in the ribs or the scapula. Among the changes are (a) abnormal curvation of the superior angle of the scapula, (b) the tubercle of Luschka and (c) tumors, especially osteochondromas of the scapula. The tubercle of Luschka is a small bony or fibrocartilaginous nodule situated on the anterior aspect of the superior angle of the scapula. Some authors have disputed this tubercle as the probable cause of the crepitation.

Four cases are reported in the paper. In his summary, Milch states that scapular snapping may vary in character and etiology. Although local conditions, such as the tubercle of Luschka or an osteochondroma, may long antedate the onset of symptoms, trauma would seem to play some part in precipitating the patient's complaints of discomfort or of disability. The sound originates as the result of contact between parts of the scapula and the chest wall. Elevation of the scapula from the chest wall leads to immediate cessation of the sound. In all instances the localization of the noise determines the site of resection. Simple removal of portions of the scapula will result in prompt and permanent cure.—*R. S. Bromer, M.D.*

Brodsky, Alexander E. Synovial osteochondromatosis of the shoulder. *Bull. Hosp. Joint Dis.*, April, 1950, *11*, 14–25.

Synovial osteochondromatosis infrequently involves the shoulder joint. The author reports 2 cases collected over a period of nineteen years and discusses the clinical and surgical problems.

This condition is considered to represent a metaplasia rather than a neoplasia. The etiological fac-

tors are unknown but trauma and infection are frequently mentioned as causative factors. The histopathological findings are identical with those of myositis ossificans.

Early removal of the bodies is advised in order to prevent the development of traumatic osteo-arthritis. Synovectomy is not indicated since active metaplasia has usually ceased by the time of surgical intervention.—*A. E. Imler, M.D.*

Thompson, Frederick R., and Winant, Edward M. Unusual fracture-subluxations of the shoulder joint. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 575–582.

In this paper a subluxation of the shoulder joint is described which consists of a fracture of the surgical neck with a subluxation. The head of the humerus teeters on the lower margin of the glenoid and is usually displaced somewhat anteriorly as well as distally. It may also be combined with fractures of the surgical neck and of the greater tuberosity, simulating fracture of the anatomical neck. It occurs both in the adduction type of fracture of the surgical neck which results from a fall on the lateral aspect of the elbow, and also in the abduction type in which the shaft is angulated outward from a fall on the medial aspect of the elbow or forearm. The authors state that this fracture-subluxation should be differentiated from a true fracture dislocation of the shoulder. It does not require manipulative reduction or open operation to replace the head in the socket. From January, 1947, to July, 1948, the authors collected 6 such fracture-subluxations. The paper is illustrated with roentgenograms of some of the cases. It is the authors' belief that the incidence of this fracture-subluxation will be increased as routine roentgenograms are taken in both the anteroposterior and lateral projections with the patient standing, especially if horizontal gravity exercises have been performed to relieve muscle spasm.—*R. S. Bromer, M.D.*

Waugh, Richey L., and Sullivan, Russell F. Anomalies of the carpus with particular reference to the bipartite scaphoid (navicular). *J. Bone & Joint Surg.*, July, 1950, *32-A*, 682–686.

The most common developmental variations of the human carpus are the os centrale and the fusion of two or more carpal bones. The bipartite navicular is of special interest to the surgeon because the condition is often mistaken for ununited fracture. This is not surprising when the following points are taken into consideration: (1) the line of division between the parts of a bipartite scaphoid is usually at the "waist" of the bone, which is frequently the site of an ununited fracture; (2) the variations of the carpus are not taken into consideration; and (3) a roentgenogram of the opposite wrist is not always obtained.

Because of the rarity of the bipartite scaphoid in the carpus and the fact that the condition is sometimes mistaken for ununited fracture, the authors report 2 cases in which this error was made. They state that an adequate knowledge of both anatomical and developmental anomalies of the carpus is necessary for an accurate differential diagnosis between such anomalies and recent or ununited fracture of the scaphoid. The division plane of a bipartite scaphoid is usually transverse or slightly oblique and is situated in the middle portion or "waist" of the bone. The roentgenogram usually reveals a clear space between the portions of a divided scaphoid. The edges are smooth and regular and usually no arthritic changes are present. However it seems logical to expect some arthritic changes in the wrist joint (traumatic osteoporosis of the carpal bones) to occur in certain individuals with a bipartite navicular who in the past have subjected their wrists to undue stresses and strains, that is trauma short of fracture. Since the anomaly is frequently bilateral, examination of both wrists is necessary.—*R. S. Bromer, M.D.*

Lindblom, K., and Hultqvist, G. Absorption of protruded disc tissue. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 557–560.

The authors state that it is well known that intervertebral disc tissue disappears. They studied the structure of intervertebral discs, based on 160 postmortem examinations, and found that radial rupture often occurs in the early stages of disc degeneration, followed by a prolapse of the disc tissue through the fissure. The herniating masses consist of nucleus pulposus as well as annulus fibrosus and may include the internal portions as well as those fibers which outline the radial rupture. All stages from radial rupture with beginning loss of tissue to almost complete disappearance of the nucleus and annulus are seen. In the intermediate stages, the bundles of the annulus appear cut off at the periphery of the disc.

The ingrowth of granulation tissue has been looked upon as a sign of repair or restitution. However, seen in relation to the macroscopic picture of disc degeneration in its different stages, it is more reasonable, the authors believe, to consider the cellular and vascular ingrowth as a sign of absorption. The disc is not replaced by invading tissue but it is "eaten." Absorption of the prolapsed portion takes place. As a result, the prolapse as well as its symptoms may disappear. The cellular and vascular reaction also leads to some fibrosis in the neighborhood of the discs, the longitudinal ligament, the dura, the roots, the ganglion and the nerves.—*R. S. Bromer, M.D.*

Rowe, George G., and Roche, Maurice B. The lumbar neural arch; roentgenographic study of ossification. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 554–557.

During the course of the roentgen examination of 40 children, in a study of the neural arch of the lumbar vertebrae, the authors were impressed by the roentgenographic appearance of the neurocentral synchondrosis in oblique views (45 degrees) of the lumbar spine, a finding of significance in both diagnostic and medicolegal evaluation. In a study of a series of postero-oblique roentgenograms of the lumbar spine in children from three to six years of age, a line was seen to be superimposed on the neural arch, which at first raised the question of a possible separation within the arch. It was found, however, that if the outline of the neural arch were traced completely in each case, the line of diminished density could be shown to lie between the pedicle and the centrum, and therefore was the neurocentral synchondrosis. The sacrum presented the synchondrosis approximately as frequently as the lower lumbar vertebrae, but the frequency of demonstration decreased steadily in each segment superior to the fifth lumbar vertebra.

The establishment of the nature of this apparent "defect" in the neural arch should dispel any misconcept that might occur to the examiner of a child whose back had been the object of trauma or the source of pain.—*R. S. Bromer, M.D.*

Barnetson, James. Osseous changes in neural leprosy; radiological findings. *Acta radiol.*, July-Aug., 1950, *34*, 47–56.

The hands and feet of 100 persons with neural leprosy were roentgenographed. The earliest osseous changes were seen on the distal margins of the terminal phalanges as minute nicks. As these nicks enlarged the tuft lost its sharp outline and became frayed. Later, the tufted portion disappeared entirely and the phalanx consisted of only a base with part of the shaft. Later still, only the base of the phalanx remained as a flat disc. This eventually disappeared and then the process extended to the more proximal bone.

The changes were always bilateral but they were rarely truly symmetrical. The atrophy which involved the bones of the feet was usually more advanced than that of the hands.

The author classified the cases as "advanced" when prominent external deformities of the hands and feet were present. The duration of the symptoms in these advanced cases varied from two to thirty-three years and, in most of them, anesthesia in the hands and feet was complete.—*Mary Frances Vastine, M.D.*

Severin, Erik. Congenital dislocation of the hip. Development of the joint after closed reduction. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 507–518.

Severin believes that arthrographic examination of the hip joint has proved to be particularly useful for the study of congenital dislocation. It permits the differentiation of dysplasia, subluxation and dislocation. Study can be made of the shape and size of the femoral head, the cartilaginous roof of the acetabulum, the adaptation of the head to the acetabulum in different positions and the width of the capsular isthmus. After reduction, the kind or degree of any soft tissue barriers can be judged. By repeated arthrograms, the development of the joint after reduction can be followed in detail. By the use of arthrograms, a proper course of treatment can be better determined upon.

The series of cases presented in the paper consisted of 115; 38 were bilateral and 39 were unilateral. All were treated by closed reduction. Arthrograms were taken at the time of reduction in all cases, both to verify the diagnosis and to study the primary effect of the reduction. In one-third of the 115 cases, one or several arthrograms were taken during the course of the treatment. The method of treatment is described in the paper in detail. Serial roentgenograms of some of the cases are included.

Severin's follow-up examinations showed that in two-thirds of the dislocated hips the femoral head was still in correct position in the acetabulum five or more years after closed reduction. His investigation led to the following conclusions:

1. In the great majority of cases of complete congenital dislocation of the hip, soft tissue interposition between the femoral head and acetabulum was shown immediately after reduction.

2. The soft tissue barrier was gradually overcome if the head was kept against the acetabulum.

3. The interposition of soft tissue had no bearing on the outcome in these cases. Thus, in itself, interposition of soft tissue does not indicate open reduction.

4. The reduction is greatly stimulating to the growth and development of the joint.

5. When the principles of treatment which he described were followed, the late results of closed congenital reduction of the hip were sufficiently good to justify further work along these lines.

6. Open reduction should be reserved for the very few cases in which closed reduction is unsuccessful.

7. Closed reduction is the method of choice in the treatment of congenital dislocation of the hip.—*R. S. Bromer, M.D.*

Massie, William K., and Howorth, M. Beckett. Congenital dislocation of the hip. Part I. Method of grading results. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 519–531.

The authors state that many studies of the results of treatment of congenital dislocation of the hip have been made, but to date no two observers have used a common system of grading which has not been subject to considerable variation of interpretation by each. They believe that their system of grading which is presented in this paper more nearly meets

the requirements which they describe than have others presented in the literature. Their system attempts to standardize all important findings, so that various observers can arrive at the same grade for any given hip. The findings which are of least accuracy are grouped together and do not lessen the accuracy of the whole. The physical findings are more accurate than the symptomatic observations, but they too will not be graded by two observers exactly alike, since an estimate of the degree of limp and hip motions will vary even between two careful observers.

The roentgenographic grade depends for the most part on actual measurements which can be checked by more than one observer and, although these measurements admittedly vary somewhat with change in projection of the roentgenograms, they believe that this variation can be minimized by attention to details. The same plan of grading can be used in evaluating the long-term results of therapy in other hip conditions.—*R. S. Bromer, M.D.*

Hart, Vernon L. Congenital dislocation of the hip in the newborn and in early postnatal life. *J.A.M.A.*, Aug. 12, 1950, *143*, 1299–1303.

The author describes (1) the earliest clinical observations, (2) the earliest roentgen features and (3) the earliest treatment of congenital dislocation of the hip. He stresses the point that actual dislocation of the hip need not occur if the early clinical signs are recognized.

The primary anatomic and physiologic abnormality which leads to dislocation of the hip is delayed and inhibited ossification of the cartilaginous structures which enter into the formation of the hip joint or innominate bone and femur. This delay in normal ossification leaves the hip socket pliable and deformable. The etiologic basis for this delayed development may be genetic, biologic, mechanical, nutritional, etc.

Subluxation and dislocation are probably closely related because both entities are frequently found in the two hip joints of the same individual. Subluxation may exist and not be recognized until adult life. Dislocation, while recognized earlier, is often not recognized or treated until after weight-bearing has begun.

The earliest clinical observations are: the sign of the jerk or click (Ortolani); signs due to postural shortening or contracture of the adductor muscles, tendons and fasciae; and femoral head displacement from the acetabulum. Normally, the flexed hips of a relaxed infant have a range of about 80° passive abduction. In the presence of hip joint dysplasia with actual displacement of the femoral head from an insufficient acetabulum or a tendency to luxation, passive abduction of the flexed hips is definitely limited.

Ortolani's sign, or the "jerk of entry" sign is the snapping sound which is heard when the displaced femoral head enters the acetabulum.

The following procedure should be performed on the infant with a dislocation of the hip to demonstrate Ortolani's sign of the "jerk of entry": the flexed hips of the infant are gradually abducted with upward and medial pressure applied under the greater trochanters; as the knees are spread apart the hips are abducted and externally rotated. A clicking or snapping sound can be felt and heard as the displaced femoral head slips into the acetabulum. After the "jerk of entry," abduction will reach the fullest degree unless there is marked shortening or contracture of the adductor muscles and tendons.

According to the author, reduction of a dislocated femoral head during the first six months of life may be accomplished without anesthesia and may be maintained by the application of a Frejka abduction pillow splint, which splint is described in detail.

The clinical signs that are observed when there is postural shortening or contracture of the adductor muscles, tendons and fasciae are fully described. Limitation of passive abduction, while not pathognomonic, may be seen in most cases of congenital dysplasia of the hip joint with luxation, subluxation and pre-subluxation.

The roentgen features of congenital dislocation of the hip are described as delayed and altered endochondral ossification or osteogenesis of the innominate bone and femur with or without displacement of the femoral head from the acetabulum. There may be tilting of the pelvis and adduction of the affected extremity secondary to adductor muscle shortening. The bony acetabulum is usually flat with the roof sloping and inadequate. The femoral head may show underdevelopment.

The author constantly emphasizes the importance of treatment of the dysplastic hip during infancy before weight-bearing begins, which will minimize and eliminate serious secondary changes of the hip joint structures. The use of the Frejka abduction pillow splint and its advantages are described. The pillow splint would seem to be an excellent and satisfactory way to manage the dislocation of hips in infants.—*G. P. Keefer, M.D.*

Miller, Leo Frederick. Bilateral stress fracture of the neck of the femur; report of a case. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 695–697.

Although stress, fatigue, spontaneous or marching fracture has been reported in all bones of the lower extremities and in the pelvis, ribs, humerus and vertebrae, the author could find no record of its simultaneous occurrence in the necks of both femurs. Roentgenograms of his patient showed fracture lines through the inner aspect of the necks of both femurs. The symmetrical appearance of the fracture lines and the absence of injury suggested fatigue fracture. However, the acute angle of the sacrum which the

patient had may have been a contributory factor. He quotes Scott who stated that mild hypothyroidism may be a predisposing systemic cause and that mild osteoporosis may develop with this condition as with hyperpituitary and menopausal syndromes. The menstrual disturbances in the case reported may have been part of such a syndrome.—*R. S. Bromer, M.D.*

Street, Dana M. Medullary nailing of the femur; comparative study of skeletal traction, dual plating and medullary nailing. *J.A.M.A.*, June 24, 1950, *143*, 709–714.

In this paper, the author presents a series of 60 cases of fracture of the femoral shaft in vigorous young men treated by medullary nailing with excellent results. Groves is credited with being the first to use medullary nails in the treatment of femoral fractures. The present method was popularized by Kuntscher in Germany during World War II.

A comparative study of the modern methods of treating the femoral shaft, i.e., skeletal traction, dual plating, and medullary nailing reveals the advantages of internal fixation. These include (1) normal healing time of the fracture as judged by the appearance and consolidation of callus, (2) better anatomical and functional results, and (3) shortened hospitalization and total disability. The author stresses the need for proper operative facilities and selection of cases to obtain uniformly good results with medullary nailing.—*T. D. Allison, M.D.*

Cave, E. F., and Rowe, Carter R. The patella; its importance in derangement of the knee. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 542–553.

This paper is based upon a study of 18 cases in which the patella was considered to be the primary factor in knee derangement. Twelve were due to chondromalacia and 6 to hypertrophic changes. After fifteen years of age, every individual may show some evidence of degeneration in the knee joint and the superficial articular-cartilage layer of the patella is the area of earliest change.

All stages of the aging or disintegrating process of the patella may be looked upon as variations of chondromalacia. The authors use this term for the more rapid fragmentation of the thick hyaline-cartilage layer in the young adult. This may appear as localized, shaggy areas of softening and fragmentation of the cartilage, or as destruction of the entire articular surface of the patella, with secondary subchondral bone production. In each of 12 cases in which operation was performed, the roentgenograms revealed a normal patella. Symptoms consist of intermittent pain over the anterior aspect of the knee and a momentary sensation of catching, followed by stiffness of slight degree and moderate swelling of the joint, atrophy of the thigh and tenderness along the medial border and the articular surface of the patella. The form of treatment to be employed is determined by the severity and duration of the symptoms in the individual case.

In the older adult, the patella may also be the cause of knee derangement, although there are usually associated changes in the condyles, in the menisci, and in the synovial membrane. The hypertrophy may develop following what the authors call chondromalacia of the patella. It may come after injury, such as fracture, or simply localized trauma without fracture, or it may be a part of the gradual aging process of the knee joint. In these cases, the characteristic roentgen findings are a markedly thickened patella, with hypertrophic changes at the patellar borders and frequently associated changes throughout the knee joint, with or without loose body formation. Many of these patients can be improved by conservative methods such as external support, heat, and muscle exercises, but in some cases these measures are not adequate and operative treatment is indicated.

If operation for chondromalacia of the patella becomes necessary, a conservative procedure, such as resection of the disintegrating cartilage, is indicated. Patellaplasty may be indicated in the severe case.

For the hypertrophic patella which is causing discomfort, patellaplasty, with removal of loose bodies and the menisci, is recommended as sufficient to give the best operative result. With every knee arthrotomy, the authors believe that the patella must be examined by palpation or by direct vision.—*R. S. Bromer, M.D.*

Siffert, Robert S., and Arkin, Alvin M. Post-traumatic aseptic necrosis of the distal tibial epiphysis; report of a case. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 691–694.

There are two main types of injury to the growing epiphyses of long bones which may produce deforming and painful sequelae. One group consists of injuries to the growth zone, severe enough to produce complete or eccentric arrest of growth. The second, and less common, type of epiphyseal injury compromises the major critical blood supply to the epiphyseal segment, producing massive necrosis. It has been observed most frequently at the proximal femoral capital epiphysis.

A case is reported of aseptic necrosis of the distal tibial epiphysis resulting from a crush injury. The authors found no previous reports of post-traumatic necrosis involving this area. The patient was an eleven year old boy who had fractures of the right ankle—a comminuted fracture of the lower aspect of the shaft of the fibula, a transverse fracture through the medial malleolus at its base and a crush injury of the lateral half of the distal tibial epiphysis. Thirteen months after the injury the roentgenogram showed an irregular, dense, sclerotic and fragmented distal epiphysis with non-union of the medial malleo-

lus. An ankle fusion was then performed fourteen months after the injury. Three years later the roentgen examination showed, in the lateral view, firm arthrodesis with full replacement of the necrotic bone.—*R. S. Bromer, M.D.*

Kite, J. Hiram. Congenital metatarsus varus; report of 300 cases. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 500–506.

The author states that congenital metatarsus varus may be thought of as being a "third of a club foot." It is a condition that has been occurring with increasing frequency during the last few years. The adduction and inversion deformity of the fore part of the foot becomes more marked during the first few months of life. Little tendency toward spontaneous recovery has been observed. The arch of the foot is higher than normal. The more advanced cases have a prominence on the lateral border of the foot. The heel is so nearly in the midline that it is almost impossible to tell whether it is in varus or valgus position. The one finding that separates these patients from those with congenital club foot is that equinus deformity is never seen in this group.

Roentgenograms show varying degrees of abduction of the fore part of the foot. There is usually valgus deformity of the heel, as evidenced by a wide separation of the anterior end of the calcaneus and the head of the talus. When anteroposterior roentgenograms are made with the fore part of the foot supinated, there is apparent bowing of the metatarsals, due to the slight normal bowing of the metatarsals toward the dorsal surface. The metatarsals appear straight when the foot is placed flat on the film.

The cases may show considerable delay in the appearance of the centers of ossification for the first and second cuneiforms. The first cuneiform may be small and the first metatarsal articulates with the medial side of the first cuneiform instead of being directly in front of it. The small first cuneiform may account for the concavity of the medial border of the foot at this site. The remaining four metatarsals form an angle with the tarsus of about 45 degrees of medial deviation. The great toe is frequently more separated from the second toe than is normal. Another finding of significance is that the center of ossification for the navicular is lateral to the head of the talus in a flat-foot position. In congenital club-foot the navicular is medial to the head of the talus

Kite divided the cases of congenital metatarsus into two groups. The first group is small and the condition is severe. All the patients have fixed valgus of the heel. The deformity was resistant to treatment and operative measures were required in most cases.

In the second group of cases the deformity is not hereditary, there are few associated congenital deformities and there is no fixed valgus of the heel. The deformity yields to treatment quite readily and shows little tendency to recur. The 300 cases reported in this paper are of this group.

The method of treatment varies according to the severity of the deformity. Casts and wedging are advised, similar to those used for the correction of the adduction deformity in club-foot. Care must be taken to prevent production of a flat-foot deformity. —*R. S. Bromer, M.D.*

Miner, Irving E. Sarcoma in Paget's disease of bone. *Bull. Hosp. Joint Dis.*, April, 1950, *11*, 26–42.

The author reviews the basic aspects of this disease and reports 8 proved cases. The incidence of sarcomatous change is given as 5 per cent and can occur in any stage of the disease. Malignant degeneration can develop in the monostotic form as well as in widespread Paget's disease.

Each of the 8 cases is described in detail and all are well illustrated. The prognosis is uniformly poor in all cases of Paget's disease undergoing sarcomatous change.—*A. E. Imler, M.D.*

Jaffe, Henry L. Aneurysmal bone cyst. *Bull. Hosp. Joint Dis.*, April, 1950, *11*, 3–13.

The term "aneurysmal bone cyst" is used to describe a bulging cystic appearing lesion frequently confused with giant cell tumor and hemangioma of bone. The shafts of long bones and the neural arch of the vertebral column are the usual sites of involvement. The flat bones may also be affected.

Most of the reported cases have been discovered between the ages of ten and twenty years, with a predominance in the female.

Attempts have been made to explain the etiology on the basis of venous thrombosis or arteriovenous aneurysm, but the whole question of origin and basic nature of the aneurysmal bone cyst is still unsolved.

The lesion is entirely benign and the treatment of choice is curettage and packing of the cavity with bone chips.—*A. E. Imler, M.D.*

Haldeman, Keene O. Factors determining the deposition and demineralization of bone. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 596–600.

In this paper, the factors behind the deposition of bone and the demineralization of bone are analyzed and an attempt to classify all conditions affecting bones on the basis of bone formation or bone destruction is made. Consideration is given to the metabolism of calcium, the metabolism of phosphorus, parathormone, local variations of hydrogen-ion concentration (pH) in or around bones, phosphatase, vitamin deficiency, protein metabolism, activity of cells, and erosion effects of invading tissue. On the basis of these factors, a classification of the diseases which affect bones is submitted. Haldeman states that as the chief reliance must be placed on the roentgenograms, the value of which lies in the

portrayal of variations in the density of bones, such a classification may be used as a chart of differential diagnosis. The classification is given in a tabulated form.—*R. S. Bromer, M.D.*

Orlandini, Ivo. Contributo allo studio dell'osteogenesi imperfetta congenita precoce. (A contribution on the study of early congenital osteogenesis imperfecta.) *Ann. radiol. diag.*, 1950, *22*, 186–199.

This article contains a lengthy discussion of the manifestations of the early and late type of osteogenesis imperfecta.

The authors report an interesting case of the early type in a newborn, who died seven hours after birth. A complete skeletal survey revealed the presence of eighteen fractures. At least half of these fractures showed evidence of callus formation and apparently were sustained during the intrauterine life of the fetus. The other fractures were probably sustained during labor and delivery. An autopsy failed to determine the cause of death in this infant.—*P. E. Russo, M.D.*

Riveros, Manuel, Codas Thompson, Quirno, and Boggino, Juan. Consideraciones clinicas, radiológicas e histológicas sobre osteodistrofia poliostótica familiar. (Clinical, roentgenologic and histopathologic discussion of familial polyostotic osteodystrophy.) *Rev. ortop. y traumatol.*, July, 1950, *20*, 1–17.

The authors report 4 cases of hereditary polyostotic osteodystrophy affecting 4 females in direct descent in the same family. The disease is characterized by maxillary deformities, reminding one of the prominent face of angels as seen in antique paintings. The lesions appear in infancy and follow a benign course throughout life. The roentgenograms show multilocular cystic areas which have a predilection for the maxillas. In all 4 cases complete roentgenologic studies were made of the entire skeleton, but only 1 case showed involvement elsewhere—a multilocular area in the triquetrum in both wrists. No blood changes were noted except hypercalcemia. Exploration of the parathyroids was done in 2 cases with negative findings. Histopathologically, the tumor showed giant cell type of tumor tissue in 2 cases and fibrous dysplasia in 1 case. One patient had a tumor of the left ovary removed but there was no demonstrated connection between it and the bone lesions. On the basis of the clinical, roentgenologic, histopathologic and pathologic studies the authors propose to call the lesion "familial polyostotic osteodystrophy."—*J. T. Case, M.D.*

Faccini, Mario. Il quadro radiologico nelle alterazioni articolari della sifilide congenita tardiva. (The roentgenological appearance of joint alterations in late congenital syphilis.) *Radiol. med.*, July, 1950, *36*, 550–565.

The problem of classification of the luetic lesions of joints has been studied by many authors from various points of view.

Hochsinger, on the basis of simultaneous involvement of the adjacent osseous heads, distinguished between two large groups: (1) joint alterations with non-participation of the osseous heads, (a) simple hydarthrosis, (b) hyperplastic synovitis; and (2) joint alterations with participation of the osseous heads, (a) syphilitic white tumor, (b) hydarthrosis with productive alterations of the articular heads (chronic deforming rheumatism of Virchow or Volkmann). To emphasize that chronic rheumatism rarely follows hydarthrosis and that the initial process is not in the osteo-cartilaginous heads, Traina proposed that the second group of Hochsinger be subdivided into (a) syphilitic white tumor and (b) chronic ankylosing and deforming syphilitic polyarthritis.

Other classifications have been suggested by Alfred Fournier, Edmond Fournier, Monnier, Milian, and others. It may be said that in general no distinction is made between the joint alterations of acquired syphilis and those of late congenital syphilis.

By taking into consideration the development of the child, the alterations of congenital syphilis are usually divided into: (1) intrauterine osteochondritis which may lead to epiphyseal detachment and secondary involvement of the articulation, and (2) a form pertaining to the period of bone growth which is the "active form" of the German investigators and which may produce both exudative manifestations and osteochondritic changes. The time of transition of this second form into that of late congenital syphilis is difficult to determine.

The author found the Traina modification of the Hochsinger classification most suitable for his own material which includes 14 cases observed between 1932 and 1947. In discussing the alterations of group 1 he extends the definition of non-participation to cover also the "inappreciable" participation of the osseous heads, since he uses roentgenologic rather than histopathologic criteria to make the differentiation. Likewise, in group 2, he uses the rather general term of chronic rheumatism for the second subdivision, thereby aiming to replace such varied names as deforming arthropathy (A. Fournier), deforming rheumatism (E. Fournier), essentially chronic rheumatism (Monnier), articular pseudorheumatism and deforming pseudorheumatism (Milian), etc.

Of the 14 patients observed by the author, 7 had joint alterations with non-participation or inappreciable participation of the osseous heads, 1 had a pure syphilitic white tumor of a knee, 5 had an association of syphilitic white tumor with periostitis and late osteochondritic changes, and 1 patient had a typical chronic rheumatism. The case histories of all patients

are presented in brief résumés, several roentgenograms being reproduced for illustration of the salient points. The differential diagnosis, which is discussed in detail, includes in group 1 tuberculous hydarthrosis, acute arthritis (streptococcic, staphylococcic, pneumococcic), osteoarthritis due to typhoid and malta fever and in group 2 tuberculous white, tumor and the various forms of articular rheumatism.

In concluding, the author states that the roentgen diagnosis of luetic arthropathies can be based only on presumptive signs and that a coordination with the clinical and laboratory findings is essential—*T. Leucutia, M.D.*

Di Rienzo, S. Die brucellöse Spondylitis. (Spondylitis in brucellosis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1950, *73*, 333–348.

Brucellosis, in its acute and chronic form, has been very common during the last ten years, and is often complicated by involvement of the spine. In various reports in the literature, such a complication has been observed in 10 to 50 per cent of all cases of *Brucella* spondylitis.

Brucella spondylitis is not limited to the bone, but occurs frequently also in the surrounding ligaments and in the discs. The involvement of the lumbar segment is more common than of any other part of the spine. Only in exceptional cases is the involvement limited to one vertebra or disc. Multiple lesions are considerably more common.

Spasm and pain are the two predominant symptoms. The pain is not characteristic in its intensity or localization but in its resistance to the usual type of medication. There seems to be no connection between the extent of the involvement and the degree of pain. If the involvement is near or at the articular facets, the nerve roots, or within the articulations, pain seems to be more intense. The pain is not related to the temperature curve.

The roentgen appearance of the spine may be entirely normal in the early stage. In some of these cases, extensive involvement, however, was found on autopsy, despite the negative roentgen findings.

Roentgenological involvement may be found in the vertebral bodies, in the discs, and in the sacroiliac joints. Lack of definition of the distinct bone structure in an acute form of *Brucella* spondylitis is a very definite early roentgenological sign. Osteoporosis and decalcification associated with attempts at bone regeneration are indicative of a more chronic form. The area of bone destruction of the vertebral body may often be small and simulate an appearance seen in so-called Schmorl's nodes. Destruction of the disc with narrowing of the intervertebral space and destruction of the adjacent parts of the vertebral bodies is quite characteristic in more advanced cases. Early signs of bone regeneration, however, occur even in the acute cases. The regeneration of the bone may be quite marked and extensive spur formation, which sometimes resemble exostoses, may occur. Calcification within the central portion of the disc and along the anterior ligaments also is commonly seen. These signs are increased during the period of reparation. Such reparation, however, may be interrupted by a reactivation of the process with renewed evidence of bone destruction. The destruction of the vertebral body and the epiphysis may be quite marked in adolescent patients. The disc is almost invariably involved in the younger person. Signs of new-bone formation and reparation may occur even in places in which no destructive evidence could be observed. Years later, the appearance may be that of a chronic degenerative type of spondylitis. Bone destruction and regeneration may occur simultaneously in various parts of the spine. Calcification of the posterior ligament is considerably rarer than in the anterior ligament.

Spondylitis in undulant fever may be quite similar to tuberculous spondylitis. However, the early and increased bone reaction and bone repair usually permit a differential diagnosis. Spondylitis in brucellosis is usually a more chronic disease than tuberculous spondylitis. Pathologically, the bone destruction is almost always accompanied by abscess formation.

The roentgenological appearance of *Brucella* spondylitis is not definitely characteristic and the diagnosis should be based upon a combination of clinical, laboratory and roentgenological findings. Multiple areas of involvement in the spinal column, various stages of bone damage appearing simultaneously, and the rather marked tendency to bone regeneration may be helpful in establishing a diagnosis of *Brucella* spondylitis.

The prognosis of the disease depends upon the general condition of the patient. The degree of involvement of the spine does not allow prognosticaton of the final outcome.—*H. P. Mueller, M.D.*

Blood and Lymph System

Lommel, F. Myeloblastenleukämie. (Myeloblastic leukemia.) *Deutsche med. Wchnschr.*, June 23, 1950, *75*, 847–849.

The author presents a case of a forty-nine year old man who had weakness for six to eight weeks and night sweats for three weeks. There had been no bleeding. Blood count revealed only 3 per cent segmented leukocytes, suggesting a granulocytopenia, but with a total white count of 13,200, which seemed to be 80 per cent lymphocytes, a tentative diagnosis of subleukemic lymphadenosis was made. Examination showed a pale man, no abnormal peripheral lymph nodes, no palpable spleen, normal chest, and no bleeding from skin or mucous membranes. Hemoglobin 63 per cent and erythrocyte count 2,340,000. There was marked anisocytosis, numerous normoblasts and megalocytes, and large nucleated red cells which looked like macroblasts or megaloblasts.

Those white cells thought at first to be lymphocytes were really myeloblasts.

Ten days later, the leukocyte count was 108,000, with subsequent fluctuation from 10,000 to 109,000. Myeloblasts varied from 70 to 90 per cent. Direct and indirect diazo reactions were negative. Sedimentation rate was 75 mm. Six months after beginning of illness there appeared stomatitis, and bleeding from skin and mucous membranes. Death occurred in nine months.

Myeloblastic leukemia is the typical form of acute leukemia which usually ends fatally within one-half to one year. The diagnosis is not always easy to establish. The well-being of a patient, with a markedly abnormal blood picture such as usually is noted with rapid death, is an exception worthy of note. The interpretation of the myeloblasts as lymphocytes is frequent and leads to an incorrect diagnosis of lymphatic leukemia. The aleukemic phase of myeloblastic leukemia may be manifested by granulocytopenia. This will not be the case when extreme leukopenia is the most significant hematological finding but when, in the beginning of the healing phase, a leukemic reaction with numerous leukocytes and myelocytes indicates reparation of the blood building structures. Prognostically, it is important to differentiate between a true myeloblastic leukemia and a reversible innocuous myeloblastic reaction. The author has contended for years than an acute myeloblastosis does not represent a leukemia but may be merely a transitory benign reaction. He has seen one patient, who is still well after thirty-seven years, who had 65 per cent myeloblasts and who became completely cured after an abortion, with rapid and total disappearance of the myeloblasts.

In not infrequent instances there are myeloblastic reactions accompanying infectious processes, the favorable course of which can be explained only in retrospect. Also, such reactions are not considered leukemic when there is sepsis or miliary tuberculosis present. Myeloblastosis seems to be a manifestation of an "essential bone marrow insufficiency." One may assume that this insufficiency exists also in true leukemia. Monocytic leukemia is usually a "mixed leukemia." Naegeli considers the existence of monocytic leukemia not to have been proved.

The unusual case of myeloblastic leukemia presented by the author suggests that injury to the bone marrow may be caused by different but related diseases which change readily from one into the other. Accordingly, acute myelosis may be associated with erythroblastosis, may follow panmyelopathy, or may occur separately.

Leukemia, like the exhaustion stage of erythropoiesis, even when appearing as an acute manifestation, is frequently an end result of previous injurious processes. These may be induced by hereditary disposition, infections, medications, metabolic poisons, industrial toxins, and radiation damage.—*Samuel Richman, M.D.*

Rubinstein, Michael A. The technic and diagnostic value of aspiration of bone marrow from the iliac crest. *Ann. Int. Med.*, June, 1950, *32*, 1095–1098.

This paper is a summary of the author's experience in bone marrow studies taken from the iliac crest in 1,000 different cases; in about 300 of these cases, simultaneous sternal marrow studies were also performed. Included in the report is a detailed discussion of the technique of iliac aspiration. It is pointed out that there are more disadvantages to sternal marrow puncture than there are with the iliac puncture. Sternal marrow puncture is not without some danger, as the heart and great vessels are beneath the sternum, and the internal mammary arteries run parallel to its borders. Although, in the literature, only a few fatalities following sternal aspiration have been recorded, the actual number of fatal outcomes is probably much larger. Iliac puncture is less painful during and especially after its performance. Repeated aspirations can be done, and thus serial aspiration marrow studies can be evaluated. The author has found that the sternal marrow studies, in many instances, have been considerably more diagnostic than the sternal marrow smears. One disadvantage of the iliac aspiration is the occasional difficulty encountered in puncturing the bone, which at times may prove exceedingly hard. But even in these instances, there is no danger in applying the necessary force, provided the technique described is used.—*E. A. Addington, M.D.*

Mazzei, Egidio S., Schaposnik, Fidel, Reca, Ricardo R., and Grinfeld, David. Trombosis crónica aorto-ilíaca (síndrome de Leriche); contralor aortográfico. (Chronic aorto-iliac thrombosis [Leriche's syndrome]; aortographic examination.) *Prensa méd. argent.*, June 30, 1950, *37*, 1428–1434.

The authors discuss the syndrome of thrombosis of the bifurcation of the aorta, which is called the Leriche syndrome in honor of its discoverer.

The syndrome evolves in two stages. The first stage, which may extend over ten to twenty years, is characterized by a compensated obliteration of the bifurcation of the aorta. The main clinical symptoms are: intermittent fatigability which is insidious in the beginning and occurs regularly with every walk later, a continuous sensation of cold in the lower extremities and in about one-fourth of the cases impossibility to obtain a firm erection of the penis due to ischemia of the corpora cavernosa when both common iliac arteries are affected. The examination reveals marked atrophy of the muscles of both lower extremities, but without trophic changes of the skin or toenails, extremely pronounced pallor which on elevating the limb assumes a peculiar cadaveric appearance and complete absence of pulsation in all

arteries of both lower extremities. Aortography at this stage gives very valuable information in permitting not only a demonstration of the presence and extent of the thrombosis but an evaluation of the existing collateral circulation as well.

The second stage follows the first stage without evident transition. It is characterized by terminal decompensation. The patient is unable to walk, has very severe pain in the legs with cyanosis and edema and there is a rapidly progressive muscular atrophy on both sides. Finally, trophic changes make their appearance followed by extremely painful gangrene, secondary infection and death.

In performing aortography, the authors proceed according to the technique of Dos Santos, which is described in detail. The aorta is entered through the lumbar route (at the level of D_{12} or L_2) with a needle 15 cm. long and 2 mm. in diameter and 50 cc. of a 70 per cent solution of nosylam (iodide salt) is injected within four seconds under 2 atmospheres of pressure. A sensitivity test is performed a few days before the examination by administering parenterally some organic iodide preparation. No untoward effects (iodism, periaortic hematoma) were observed; on the contrary, all patients experienced a subjective and objective improvement for several days after the injection.

In discussing the treatment, the authors consider three possibilities: (1) in a first group of patients whose symptoms are predominantly functional and who are in the stage of compensated obliteration, aortectomy combined with bilateral lumbar sympathectomy is performed; (2) in a second group of patients, representing more advanced cases at the borderline of decompensation and in whom marked periaortitis is found at operation, bilateral lumbar sympathectomy alone is performed, and (3) in the patients of advanced age with frank decompensation, no operation is undertaken but supportive measures are applied to improve the general condition.

Six cases, 5 of which were in an early and one in a late stage, are reported in detail. The aortograms, which were of great help in establishing the correct diagnosis in all cases, are reproduced, together with supplementary diagrams indicating the degree of obstruction as well as the extent of the collateral circulation.—*T. Leucutia, M.D.*

Kinmonth, J. B. Arteriosclerosis; thrombosis of iliac arteries. *Proc. Roy. Soc. Med.*, June, 1950, *43*, 480–481.

The case history of a fifty year old male with a twelve year history of progressive claudication in both calves, and numbness and coldness of the right foot is presented. The diagnosis of thrombosis of the iliac arteries was made, and relief was obtained by a thoracolumbar sympathectomy.

Plain roentgenograms showed calcification in the anterior and posterior tibial arteries of both sides. Aortography showed a block in the right external iliac extending as far as the common femoral. On the left side the internal iliac was not seen, and at its expected point of origin from the common iliac there was a well-marked notch presumably due to thrombosis.

Angiography showed the high level of the obstruction, and the need for a sympathectomy extending higher than the routine lumbar procedure if the collaterals around the blocked segment were to be denervated.—*D. R. Bernhardt, M.D.*

General

Sosman, Merrill C. The specificity and reliability of roentgenographic diagnosis. (Shattuck Lecture.) *New England J. Med.*, June 1, 1950, *242*, 849–855.

The author discusses in extenso the value of roentgen diagnosis and its reliability in the various systems. He not only states his own experience but that of other careful observers. Gross pathological changes can be diagnosed in 90 per cent of the cases, congenital anomalies in 5 per cent and alterations of physiology in a small per cent.

Sosman feels that the diagnosis of pulmonary lesions can be made in 75 to 80 per cent of cases with perhaps an added 5 per cent when special techniques are used.

In their clinic they demonstrate 80 to 85 per cent of all significant lesions of the gastrointestinal tract and, having perceived them, can correctly identify 90 per cent of the lesions.

In the osseous system 90 to 95 per cent of the lesions are demonstrated and at least 95 per cent are diagnosed. The exceptions are metabolic diseases, early metastatic lesions, early osteomyelitis and certain primary bone tumors. It is important to note that of the patients examined for low backache, 10 per cent show no pathological changes.

In the genitourinary tract 90 per cent of the lesions are demonstrated and an equal number identified.

The author's unusual experience and associations have made him one of the leading diagnosticians of lesions of the brain. He is able to demonstrate at least 95 per cent of all intracranial lesions: however, only about one-third of these are identified.

As regards gallbladder disease, he lists positive diagnosis by roentgen procedure in 95 per cent of the cases with errors due to technique.

The over-all results are summarized in the following table:

System	Demonstrate	Identify
Lungs	95	75 to 80
Gastrointestinal tract	80 to 85	90
Bones	90	95
Genitourinary tract	90	90
Plain films	47	50
Brain—special techniques	98	30
Gallbladder	80	99*

* Of all cases.

—*C. H. Warfield, M.D.*

Freeman, Joseph T. Ehlers-Danlos syndrome; case report. *Am. J. Dis. Child.*, June, 1950, *79*, 1049–1056.

The syndrome of Ehlers and Danlos is apparently a constitutional dyscrasia of the mesenchyma, charaterized by specific manifestations in the skin, joints and subcutaneous tissue, often associated with other congenital defects. The general pattern is accepted as consisting of excessively elastic skin, exceedingly lax joints, abnormally fragile skin and blood vessels and a tendency to the formation of pseudomolluscous tumors at the site of trauma and of subcutaneous nodules which may manifest necrosis and calcium deposits.

The patient was a girl, aged thirteen, of Italian descent. The roentgen findings were unusual in that examination of the hands in normal repose showed shortening and lack of development of the proximal phalanx of the fifth finger in each hand, and the teleoroentgenogram showed fullness of the cardiac silhouette in the region of the left upper border of the heart. The latter was regarded as suggestive of an interatrial defect. This combination of changes has not been noted in the many other reports in the literature.—*R. S. Bromer, M.D.*

Gordon, Stuart. Melanotic sarcoma. *Canad. M. A. J.*, July, 1950, *63*, 16–18.

Melanotic sarcoma accounted for 0.35 per cent of all admissions to Toronto General Hospital from 1934 to 1948. It would seem reasonable to assume that a melanotic sarcoma usually, if not always, arises in a mole or melanoma. The commonest factor responsible for the change from melanoma to melanotic sarcoma would appear to be trauma. The spread is chiefly by the lymphatics but occasionally by the blood stream, even a fetus in utero may be seeded.

Surgery is the treatment of choice consisting of complete excision with a wide, deep base. Regional lymph nodes should be removed, preferably in one block. Only 2.5 per cent show any favorable response to irradiation.—*R. J. Reeves, M. D.*

Pirkey, Everett L., Reed, Edsel S., and Smith, William H. Clinical studies of the use of emulsion of ethyl iodophenylundecylate (pantopaque). *Radiology*, July, 1950, *55*, 89–93.

The preparation of an emulsion with a 50 per cent mixture by volume of pantopaque with water, containing a surface active agent, is described. The emulsification increases the surface area of the compound and therefore increases the toxicity. This was demonstrated in animal experimentation.

The clinical use of the emulsion for cholangiography, bronchography, urethrography, esophageal studies, and for visualization of sinuses, fistulas and diverticula is discussed. In bronchography, the results were uniformly less satisfactory than with ordinary iodized poppyseed oil. Severe reaction of violent coughing and bronchial spasm developed in 2 patients.

It is concluded that the emulsion of pantopaque seems to offer several advantages over the contrast media now in use:

1. Ability to adhere to mucosa
2. Low viscosity
3. Low surface tension
4. Miscibility with tissue fluids
5. Good radiopacity

—*E. E. Seedorf, M.D.*

Boecker, W. Röntgenologisch nachweisbare Muskelfiederung bei Dystrophia musculorum progressiva. (Feathery appearance of muscle in progressive muscular dystrophy; as demonstrated roentgenologically.) *Deutsche med. Wchnschr.*, July 14, 1950, *75*, 93 – 940

The feathery appearance of muscle noted roentgenologically in progressive muscular dystrophy is due to an increase in its fat content. Numerous dark lines are seen coursing in the direction of the muscle bundles. In the head of the gastrocnemius, the pattern resembles a fish skeleton. There is an associated decrease in muscle density which is attributed to a deficiency of myoglobin. The roentgenologist may now help to determine the extent and degree of muscle involvement. Furthermore, he can differentiate between real and pseudohypertrophy, since only the latter condition shows these changes.—*Joseph Zausner, M.D.*

Sterling, Kenneth. Erythema nodosum with tuberculin-neutralizing serum; report of two cases. *Am. Rev. Tuberc.*, July, 1950, *62*, 1-A, 112–115.

Two cases of erythema nodosum with hilar lymphadenopathy and polyarthritis are described.

Serum from each of these 2 patients was mixed with old tuberculin so that the final dilution was 1:10,000. This mixture from each case was injected intradermally into one arm of each of 5 known tuberculin reactors and into the opposite arm of these 5 subjects was injected 1:10,000 old tuberculin in saline as a control. Four of the 5 known reactors exhibited erythema and induration forty-eight hours after the control tuberculin injection, but no reaction, or a trace, at the site of the injected tuberculin-serum mixture. The tests were interpreted as indicating the presence of tuberculin-neutralizing properties in the sera of both cases of erythema nodosum. In each series of experiments a fifth known reactor exhibited induration on both arms, possibly indicating a sensitivity to the serum, but in any event not

invalidating the results of the other four tests.

A similar phenomenon has been described by Wylie and Wills in cases of sarcoidosis.—*W. A. Klauber, M.D.*

Howles, James K. Sarcoidosis in the Negro. *South. M. J.*, July, 1950, *43*, 633–642.

The article deals mainly with a study of 42 cases of sarcoid in the Negro race. However, in addition, a very complete discussion of the complicated disease and all of its ramifications is given.

Sarcoidosis is primarily hematogenous and capable of involving many organs, producing fairly characteristic pathological lesions, sometimes regressing spontaneously, sometimes terminating in tuberculosis. It is commonly believed to be an attenuated non-caseating form of tuberculosis. However, this has not yet been proved.

The diagnosis of sarcoidosis depends upon a convincing over-all structure proved histopathologically plus substantiating clinical evidence. The disease favors adult life. The greatest incidence in this series was observed between 31–40 years of age, the extremes being 6 and 65 years. Skin lesions were present in only 18 of the 42 cases and the eruption presented no unusual manifestations. It is the opinion of the author that there is no classical lesion of sarcoidosis found on Negro skin. The most common form consisted of small firm nodules found most frequently about the face, arms and trunk.

In the author's series almost half of the cases were free of clinical evidence of adenopathy although this is reported as a common finding by most observers. The peripheral nodes were discrete, non-tender, firm and, as a rule, were not attached to the underlying tissue. They showed no tendency to suppurate. When the hilar adenopathy was unilateral it was almost always present on the right side.

Thirty-one of the cases showed some involvement of the lungs as shown by roentgen study. The high incidence of pulmonary lesions or hilar adenopathy in sarcoidosis makes it imperative to do a roentgenologic examination in all suspected cases. It is felt that when this examination remains negative, one must be cautious in making a definite diagnosis of sarcoidosis.

The author quotes Woods who states that an estimated 50 per cent of sarcoid patients show ocular manifestations. Uveoparotid fever (Heerfordt's disease) and Mikulicz's syndrome are such manifestations. Other forms of ocular sarcoidosis are discussed.

Of 32 biopsied cases, 27 were positive for sarcoid and 5 compatible. A discussion of the histopathological appearance is given.

The incidence of a negative tuberculin test is estimated to be as high as 60 to 80 per cent. In this group of cases, 31 were negative, 6 positive and 5 were not tested. Of the 6 positive cases, only 1 gave a history of contact with tuberculosis.

The benign nature of most cases of sarcoid makes it difficult to evaluate the many types of therapy employed. The new antibiotics, such as streptomycin, aureomycin and chloromycetin have not been used long enough for proper evaluation, but deserve thorough trial.

Most cases, except those with extensive internal involvement, have a relatively good prognosis. The mortality rate is about 5 per cent.—*J. G. Snead, M.D.*

Warthin, Thomas A., Cooper, John F., and Caputi, Anthony P. Clubbing of digits, metaplasia of urinary bladder and mucous diarrhea. *Arch. Int. Med.*, July, 1950, *86*, 10–21.

The association of clubbing of the fingers with various disease states has interested physicians for many years. Mendlowitz carefully analyzed all reports of the syndrome in 1942 and grouped all bilateral symmetric cases as acquired, hereditary or idiopathic. The acquired condition was associated with certain pulmonary, cardiac and gastrointestinal disorders, and a rarely seen miscellaneous group of diseases. The hereditary group was considered to be a separate entity. In the so-called idiopathic group a single case associated with urologic abnormalities was cited but not discussed. Mendlowitz also stated that hypertrophic osteoarthropathy represented a more advanced state of simple clubbing.

The authors report on 4 male patients who presented a symptom complex of extensive clubbing of their digits, hypertrophic osteoarthropathy in 1 patient, urinary frequency and urgency, associated with striking metaplasia of the urinary bladder, and frequent mucous stools and tenesmus. Two of these patients claimed to have had some clubbing much of their lives, although their urinary and rectal symptoms were of more recent onset. One of these gave a family history of clubbing. The remaining and more severely disabled 2 patients had noted the sudden onset of clubbing during military service, months before the appearance of their other symptoms. It was the later, rather explosive onset of urinary and rectal symptoms which eventually precipitated their separation from the military service. All 4 were admitted to the hospital largely because of urinary or rectal complaints. During the five or more years while they were under medical observation, there were no apparent pulmonary, cardiac or other diseases associated with clubbing of the fingers.—*A. B. Smith, M.D.*

RADIATION THERAPY

Whipple, Allen O. Radical surgery in the treatment of cancer. *Ann. Surg.*, June, 1950, *131*, 812–823.

In evaluating the validity and justification of

radical surgery in the treatment of cancer in its anatomical distribution and organic involvement, certain factors must be weighed: (1) the treatment of the disease, as to life expectancy, dysfunction, disability and distress; (2) the operative risk; (3) the probability of cure; (4) the assurance of relief of symptoms even though palliative and temporary; (5) the ability of the patient to tolerate dysfunction and deformity, inevitable in some of the radical procedures; (6) the quality of the resident staff in the essential pre- and postoperative care of the patient; and (7) the experience, skill and integrity of the surgeon.

The operative risk is steadily decreasing in almost all the radical procedures. When hemipelvectomy was first attempted the operative risk was approximately 40 per cent. Recently, Morton of the Memorial Hospital reported 8 consecutive procedures of this type without an operative mortality. Coley and Pack reported 27 consecutive cases from the Memorial Hospital with a similar result—no operative mortality. In the first ten years of radical pancreatoduodenectomy at the Presbyterian Hospital in New York, the mortality was approximately 33 per cent in some 30 patients. During the past two years, Parsons and Lockwood report 17 such consecutive procedures without an operative death. Cattell in Boston has reported 40 radical operations for ampullary carcinoma with only one death.

There have been 62 complete pelvic exenterations. Among these are 4 patients who have lived more than two years without evidence of recurrent disease and 3 patients who have survived from one year to one year and ten months without evidence of recurrent disease. This latter group was of the extreme advanced and hopeless type.

Carcinoma of the stomach is one of the most common and serious cancers encountered. The overall salvage rate is low. At the Columbia-Presbyterian Clinic, of 256 patients with gastric resection for carcinoma of the stomach, 56 are living five years or more without evidence of recurrence, 32 are living between five and ten years, and 24 have survived ten years or longer.

At the Memorial Hospital, a study of the end results in the treatment of gastric cancer reveals that 75 patients survived gastrectomy performed five or more years ago, 26, or 34.7 per cent, lived five years or more without recurrence. Patients without lymph node metastasis had 42.8 per cent five year survival without recurrence; those patients with proved lymph node metastasis had 24.2 per cent survival.

Many esophagectomies and pneumonectomies, as well as pancreatic resections for cancer, must be considered palliative. This is a problem involving the psychology of the patient. It is especially true in patients requiring colostomies, extensive amputations, laryngectomies, and in women requiring hysterectomy or radical mastectomy.

Subtotal gastrectomy for cancer is an inadequate procedure in terms of the type of surgery applied to cancer elsewhere.

In performing radical excision of the duodenum and total gastrectomy, all the gastrohepatic omentum, the lymph nodes beside the esophagus, the group of lymph nodes in the omentum, and those between the greater curvature and the splenic region can be removed.

This is not an operation to be done universally, and is really an experimental procedure.—*S. N. Tager, M.D.*

Collins, Vincent P., and Pool, John L. Treatment of antral cancer by combined surgery and radium therapy. *Radiology*, July, 1950, *55*, 41–45.

Either surgical treatment or irradiation of antral cancer may produce survivals of five years or more; however, failures frequently occur because of insufficient resection or irradiation. A combination of these two methods offers the best treatment available for this condition.

The radiotherapist should be present at the time of surgery in order to know the extent of the condition he will be called upon to treat. The operation itself may be limited to either a peroral resection of the antral floor or a more radical resection of the maxilla by means of the Weber-Ferguson incision.

In most cases a radium applicator can be tolerated ten to fourteen days after surgery. The applicator is fashioned in clear dental acrylic and the area on the mold which will be apposed to the region to be treated is mapped out. The mold is drilled and fitted for the radium applicator. A brass replica of the radium tube is placed in the mold which is inserted in the surgical defect. Roentgenograms are then taken in the lateral, posteroanterior, and frontosubmental planes to demonstrate the position of the radium source. Then, centering on the radium tube, a circle is drawn on the film to include the tissue to be irradiated. This will vary from 3 to 6 cm. in diameter. If the zone exceeds 6 cm., roentgen therapy will be necessary.

Dosage is calculated on the basis of roentgens delivered to the surface of a sphere (the diameter obtained from the roentgenograms), considering the radium as a point source. The number of roentgens delivered per 100 mg. hr. is obtained from a graph of radium dosage for a point source. Treatment time will vary from five to seven days. Both minimum and maximum dosage should be determined. The maximum reaction will develop in ten to fourteen days. Removal of slough by power spray and scissors will be necessary at frequent intervals. In four to six months the operative defect can be closed by an upper plate prosthesis.—*E. M. Cooper, M.D.*

Schulz, Milford D. Supervoltage roentgen

therapy in cancer of the mouth and throat. *Radiology*, July, 1950, *55*, 52–59.

It is generally conceded, with a few exceptions, that in treatment of oral cancer, supervoltage therapy as now employed has not been more effective than roentgen rays generated at 200 to 250 kilovolts.

In the treatment of patients at Massachusetts General Hospital with inoperable carcinoma of the tongue there was a five year survival rate of 20 per cent when supervoltage therapy was used as compared to 18 per cent when 200 kv. irradiation was employed. In the treatment of carcinoma of the tonsil, supervoltage therapy (tumor dose of 5,000 r with a five year survival rate of 24 per cent) appeared to give better results than roentgen rays generated at 200 kv. (tumor dose of 3,000 r with a 6 per cent five year survival rate).

There are certain definite advantages when supervoltage therapy is used. There is less damage to normal structures about the tumor. It spares the skin. When 1,200 kv. irradiation is used, doses of 5,000 to 6,000 r can be given to a tumor lying 5 to 8 cm. deep. One must keep the total tumor dose in mind for changes in the skin are of no value in estimating the time of treatment. Another advantage of supervoltage therapy is that there is no loss of depth dose with diminution in field size.

Finally, in the supervoltage range, the absorption of roentgen rays is less dependent upon the atomic number than in the lower therapeutic ranges. Theoretically, there should be less damage to the bones about the tumor undergoing treatment; however, this does not hold true in practice, especially when infection is present. Good preventive oral hygiene will reduce the danger of bone necrosis whether supervoltage or 200 kv. roentgen therapy is used.—*E. M. Cooper, M.D.*

Martin, Charles L. Treatment of cervical lymph node metastases with irradiation alone. *Radiology*, July, 1950, *55*, 62–71.

This paper is a refutation of the statement that block dissection offers the only chance of cure after metastases appear in the lymph nodes of the neck.

Radiation therapy sufficient to control lymph node metastases secondary to transitional cell carcinoma of the pharynx is inadequate to control squamous cell carcinoma growing in lymph nodes. Various methods of combining external irradiation with interstitial radon seeds or radium needles are discussed.

The author's technique is a combination of implanted low-intensity radium needles and roentgen therapy. Low-intensity radium needles are inserted in a planar pattern designed to irradiate the lymphatic bed efficiently well beyond the involved lymph nodes. They are left in place for seven days and are so spaced that they deliver doses ranging between 12,000 and 6,000 gamma roentgens to the implanted subcutaneous tissues. On the day after the needles are put in place roentgen therapy is started. Daily doses of 350 r, measured in air, are given up to a total of 2,100 r. Treatment factors are 220 kv., a target-skin distance of 50 cm., a Thoraeus filter (0.4 mm. of tin) and a tube current of 20 ma. The portal, which is centered over the palpable lymph nodes, is ordinarily about 10 by 15 cm. The entire procedure is carried out in seven days.

Reactions are not excessive and unfavorable late effects are few. Tissue necrosis and necrosis of the mandible should not occur unless the primary lesion and the lymph node-bearing area are treated at the same time. The neck should be treated only when nodes are palpable and only after the primary lesion has been eradicated.

This type of therapy has been used in more than 300 cases by the author since 1935. Results obtained in the 146 cases treated more than five years ago are tabulated. Forty patients, or 27.3 per cent, were alive and well for five or more years from the time of treatment. Survival rate thus falls in the same range as that reported for block dissection.—*A. W. Sommer, M.D.*

Eberhard, Theodore P., and Leaming, Robert H. Treatment of carcinoma of the nasopharynx by irradiation. *Radiology*, July, 1950, *55*, 46–51.

The basic problems in the treatment of carcinoma of the nasopharynx are: the localization of the tumor, the delivery of an adequate tissue dose, and the maintenance of the patient's health and morale during the treatment.

For localization one must utilize direct inspection and roentgenograms. Without involvement of bone one may expect a 40 per cent five year survival rate; with it, only about 10 per cent will survive. Biopsy is of prognostic importance as only in the lymphosarcoma and lymphoepithelioma groups and a very few of the differentiated carcinomas will one be successful in effecting a cure.

The ideal goal is the administration of 4,000 to 4,500 r to all parts of the tumor in four weeks. In extensive cases one may (1) treat the primary tumor first and the lymph node masses later, (2) reverse this order, or (3) treat the entire area at once, increasing the total dose in order to compensate for the prolonged treatment time.

Four fields, two lateral and two antral, the size and shape depending on the site and extent of the primary tumor, are used for treatment. The cervical lymph nodes are treated separately with lateral fields. The author does not use the frontal or suboccipital fields. Isodose curve overlays, which can be placed on roentgenograms of the patient, provide the best means of planning the treatment. Each patient must be individualized and the treatment will often have to be modified from day to day.

Severe skin reactions may necessitate the use of radium. This may be applied by the Blady applicator or even by a small cork containing a radium tube. Primary reliance should never be placed on these local sources.

It is of great importance to give both the patient and the family as dark a picture as possible of the severe reactions which may occur. The patient will be less frightened and will have more confidence in the therapist when these reactions appear. Caloric, liquid, and vitamin intake must be rigorously maintained at high levels.—*E. M. Cooper, M.D.*

Wilkins, George C. Carcinoma of the cervix; a report of 200 cases treated with radium and x-rays. *New England J. Med.*, June 8, 1950, *242*, 895–896.

The author reports a series of 200 cases of carcinoma of the cervix treated first with roentgen rays, then followed by radium.

In 1941 he reported on 200 cases treated with radium alone. This article deals with a comparison of the two methods. The amount and method of application of the radium were the same in both series.

In the first series of 200 cases he reported a 37 per cent five year salvage. The percentage was the same for his last series using the two methods on the same patient. The roentgen treatment stopped the bleeding, decreased the vaginal discharge and cleared up the secondary inflammation. The total roentgen dose varied between 7,600 and 9,000 r and that of the three radium applications was 5,600 to 5,800 milligram hours.—*C. H. Warfield, M.D.*

Donaldson, Malcolm. The future in the treatment of carcinoma of the cervix. *J. Obst. & Gynaec. Brit. Emp.*, June, 1950, *57*, 411–414.

A comparison of the League of Nations report of 1938 and that of 1949 (yet to be published) reveals an increase in the percentage of cases in Stages I and II at the expense of Stages III and IV. However, the percentage of Stage I varies from 2.9 to 29 per cent from the various centers, the reports depending on factors of opinion, selection, etc., thus making it almost impossible to judge the value of different techniques on the five year survivals. This indicates that the greatest value of staging lies in its use by one group of institutions working together and evaluating their own techniques.

A second observation is that there has been a slight improvement in the Stage I results, marked improvement in Stage II, but practically none in Stages III and IV. Nonetheless, 53.8 per cent of Stage I and II treated cases still die within five years. The author points out that lymphatic spread is the most important cause of failure; the radiological and surgical approaches are discussed.

"Radiocurable" and "radioincurable" should be adopted as terms, distinguished from, and used in preference to radiosensitive and radioresistant. Radiocurability is judged microscopically by the cell count method of Glucksmann, which is reviewed in principle. Thereby a radioincurable tumor could be attacked surgically before *macroscopic* clinical radioresistance becomes evident.

Other factors pointed out by the author to improve results in all stages are: (1) to educate the public as well as general practitioners in order to secure earlier diagnoses; (2) to further individual cooperation between gynecologist and radiologist as well as between institutions, this last in order to obtain sufficient data within a reasonable period from which to draw conclusions; (3) to continue the improvement of radium applicators, irradiation techniques and surgical methods until such time as those working out chemotherapy come through with the final answer to the cancer problem.—*J. D. Reeves, M.D.*

Johnson, W. O., and Weinfurtner, B. J. Carcinoma of the cervix associated with pregnancy. *Am. J. Obst. & Gynec.*, June, 1950, *59*, 1189–1201.

As is true of all cancer in accessible sites, the authors point out that the diagnosis of cancer of the cervix associated with pregnancy presents few difficulties.

Immediate and full investigation of abnormal discharge or bleeding in both pregnant and nonpregnant women is a practice essential for diagnosis early enough to hope for cures. Cervical visualization and biopsy of all abnormal areas should be routine. With proper technique, there is no danger of abortion or of excessive bleeding in the pregnant patient.

Treatment of cervical lesions during pregnancy should be confined to cases of proved malignancy. Benign lesions should be carefully watched, suspicious lesions should not be treated until repeated smears and biopsies have resulted in a definite diagnosis of malignancy. The patient should not be subjected to irradiation which may deform or destroy the fetus and injure the mother until the necessity has been established. Unusual care in pathological diagnosis is most important, for cellular variations in the cervix during pregnancy are not too well known and may, if not thoroughly understood, be confused with malignancy.

The authors report a series of 12 cases. They conclude that in League of Nations Stage I and II cervical carcinomas, (*a*) the uterus should be emptied by hysterotomy, (*b*) radium should be inserted into the uterus and on either side of the cervix to over 4,000 to 5,000 mg. hr. in one to three applications, (*c*) deep roentgen therapy should be delivered through four to six portals for a total of 4,000 to 6,000 r in air, and (*d*) six weeks to three months later, a radical resection of the uterus, tubes, ovaries and

pelvic and iliac glands (Wertheim type) should be performed. In Stage III and IV cases, they feel that *a*, *b*, and *c* should be carried out, *d* should be considered in the more favorable cases. In obviously hopeless cases discovered before the fetus is viable, treatment may be deferred until the child can be saved. For carcinoma in situ, the authors feel that TeLinde's plan of radium followed by wide excision (after emptying of the uterus) is probably best.—*George Cooper, Jr., M.D.*

Ellis, Frank, Elson, L. A., Jolles, Benjamin, and Koller, P. C. Discussion on the chemical factors modifying radiotherapeutic response. *Proc. Roy. Soc. Med.*, June, 1950, *43*, 399–410.

Dr. Frank Ellis: The increase of the margin between the tolerance of normal tissue and the sensitivity of malignant cells to radiation would be a major step in the advancement of radiotherapeutics. It may be possible to condition malignant cells so that they are destroyed by smaller doses of radiation than are now used. Two methods available through which this goal may be achieved are the adjustment of the time-intensity relation of treatment and the use of chemical substances.

The presence of a second substance in solution either independent of, or derived from, the original substance may protect the latter from the effect of irradiation. The different protective effects of various organic and inorganic substances have been demonstrated. The protective effect of a sulfur atom in a molecule has been shown to be of a high order. This may be significant when one considers the importance of the sulfhydryl groups in biological reactions. Thus the possibility of influencing tissue reaction to an ionizing beam by varying its chemical environment is suggested.

The contention that the effect of radiation on tissue is changed by varying its physical and chemical environment is supported by the following clinical and laboratory observations:

Increasing the concentration of oxygen to 5 cc. per liter greatly increases the sensitivity of the growing broad-bean root tips to radiation. The presence of oxygen favors the inhibition of mitosis and production of abnormal mitosis. This suggests that the lack of oxygen in severe anemia might affect the response of a malignant tissue to irradiation. Sepsis is helped by small doses of radiation, but interferes with tumor response to irradiation. It may be that the inflammatory reaction conflicts with the malignant cells for available oxygen, thus diminishing the sensitivity of the dividing cells to irradiation.

Other causes of changed response of tissue to irradiation are presented. The possibility of antibody formation against the tumor is suggested.

Possible clinical applications would include the giving of oxygen during therapy, therapeutic diet and the use of chemical substances to inhibit cell respiration so that malignant cells would be more sensitive to irradiation or would be unable to recover following cell damage by irradiation.

Dr. L. A. Elson: These investigations of the effect of diet in the response of tumors to irradiation were the outcome of the discovery that the body growth- and tumor growth-inhibitory action of carcinogenic chemicals is profoundly influenced by the protein content of the diet. The experiments performed on rats given a diet containing 5 per cent protein and 20 per cent protein showed that the initial response of the tumor to irradiation was favored by a low protein diet and the elimination of the inhibited tumor was favored by a high protein diet. By suitable fractionation of the dose (high initial dose with later decreasing dose rate) it is possible to apply direct to the tumor a first dose of radiation sufficiently high to bring about an adequate initial growth-inhibitory response even in animals maintained on a high protein diet. The outcome of therapy then depends almost entirely upon elimination of inhibited tumor.

Further it was indicated that high protein diet protected the whole animal from deleterious effects of irradiation.

Dr. Benjamin Jolles: A new concept of dose fractionation is discussed. By means of a checkerboard-like filter containing alternating radiolucent and radiopaque squares (1 cm.^{2}) a spatial as well as a temporal separation of radiation dosage is achieved. After a suitable period of treatment the pattern is reversed to expose the previously protected areas. In volunteers, an area of skin irradiated in this manner gave a greater reaction than that of a single area of skin exposed to the same dose of radiation.

The hypothesis of a diffusible substance liberated in the irradiated tissue is elaborated to explain this observed phenomenon.

Dr. P. C. Koller: Reference is made to the work of Elson and Jolles which has been mentioned in the above paragraphs.—*D. R. Bernhardt, M.D.*

Miller, C. Phillip, Hammond, Carolyn W., and Tompkins, Marianne. Reduction of mortality from x-radiation by treatment with antibiotics. *Science*, June 30, 1950, *111*, 719–720.

A previous series of experiments with mice showed that infection, in combination with the marked reduction in the animal's natural resistance to it, might be a significant factor in death from radiation injury. The bacteremia was found to be caused by micro-organisms normally inhabiting the lower intestinal tract of these mice.

The present experiments were conducted to determine the effect of various antibiotics on the mortality of mice exposed to roentgen radiation, 450 r.

A group of mice treated with streptomycin from

the fourth to the twenty-eighth day after irradiation showed significant degrees of protection.

Chloramphenicol (chloromycetin) was somewhat less effective than streptomycin alone or in combination with penicillin. Polymyxin B in non-toxic doses failed to influence the mortality. Results with aureomycin were irregular.—*J. J. Gormley, M.D.*

Nittinger, Dora. Ergebnisse der Strahlenbehandlung von Hypophysentumoren. (Results from radiation therapy of hypophyseal tumors.) *Strahlentherapie*, 1950, *82*, 367–378.

After a review of the anatomic abnormalities of the hypophysis and a discussion of their differential diagnosis, the author presents 42 cases of pitutiary tumor treated by irradiation since 1932. Eleven of the 42 patients were lost to follow-up.

Eight of the remaining 31 cases were treated before a uniform radiation technic was introduced in 1942. The earlier treatment consisted of 40–100% of a skin erythema dose administered to each of three or four fields (each temporal, a frontal, and occasionally an occipital), this series being repeated three or four times at intervals of 3–12 months. Two of the eight patients died of their pituitary tumors. Four of the others received repeated series of radiation to a probable total dose of 5,000–6,500 r; their condition remained static to the present or until they died of diseases of old age. Isolated observations in this group of patients treated before 1942:—Two cases of diabetes insipidus were cured. Vision improved in the seven cases in which it was impaired. A single instance of abducens paralysis was cured. Only one instance of hormonal insufficiency was observed, a case of insulin-resistant diabetes mellitus.

From 1942 on, fractionated roentgen therapy was administered through 7–9 fields—300 r daily to one or two fields to a total dose of 15,000–18,000 r. Twenty-three cases were thus treated.

Eight were acromegalic; of these five have survived 5–8 years. In the survivors irradiation had a definite effect: The extremities ceased to enlarge, one patient even pointed out a decrease in the size of the hands and feet; in two cases of obesity, that finding decreased; in one patient, menstruation recurred. Of the three deaths, one was due to cardiac decompensation unrelated to the pituitary tumor.

Two cases of Cushing's disease were favorably influenced. One showed an enlarged sella and atrophy of the optic nerves.

The remaining 13 cases had chromophobe adenomas; of these five are dead.

A single series of radiation therapy carried to high dosage is more likely to prevent recurrences than are repeated smaller series. Of 7 patients in whom total dosage was less than 5,000 r, 4 showed recurrent growth which required further treatment. Of 14 patients in whom total dosage was 10,000–18,000 r, only 3 showed evidence of recurrence.

Histologic proof is lacking in all of the cases reported.

In summarizing, of 31 cases of pituitary tumor treated by irradiation, 15 showed considerable improvement which has remained—in 12 the observation period was from 5–13 years. In 6 patients, repeated series of radiation therapy were necessary to bring the disease to a standstill; their follow-up period has been from 5–15 years. Four patients showed improvement after therapy but then progress of the tumor ultimately led to death. In four patients radiation therapy was without effect. Two patients died of intercurrent disease after improvement following radiation therapy.—*H. G. Moehring, M.D.*

Boden, Geoffrey. Radiation myelitis of the brain-stem. *J. Faculty of Radiologists*, July, 1950, *2*, 79–94.

The author gives case reports on 7 patients who received brain stem damage, 4 after treatment of carcinoma of the middle ear, 2 for nasopharyngeal malignancy, and 1 for a parotid neoplasm. In treatment of carcinoma of the middle ear a circular field was applied on the same side as the lesion, centered on the anterior margin of the external auditory meatus, and with the central ray passing through the middle of the tegmen tympani in the true coronal plane of the skull. From the contralateral side four, five, or six circular fields, arranged in a cluster, were directed so that their central rays met at the middle of the tegmen tympani on the far side. The fields used were circles of 5 cm., 6.5 cm. or 7.5 cm. in diameter, and the radiation factors were 250 kv., half-value layer 1.65 mm. copper, focus field distance, 40 cm.

In a typical case in a patient with an acoustic neurinoma on the right side, treatment was given through a 6.24 cm. circular ipsilateral portal and through six 5 cm. circular contralateral portals for a total depth dose of 5,500 r in seventeen days. The brain stem dose by this technique was 6,050 r. Thirteen months after clinical recovery the patient developed right 5th, 6th, 7th, 8th, and 9th cranial nerve palsies, nystagmus, ataxia, incoordination of the right limbs, and left-sided hypoesthesia. Cerebrospinal fluid: pressure 335, cells 4, protein 90. Blood and cerebrospinal fluid Wassermann reactions negative. Died after six months. At postmortem an acoustic neurinoma about 1 cm. in diameter, much sclerosed, was present on the right side, but there was no tumor or necrotic bone in the petrous temporal. The right pons, superior cerebellar peduncle, and upper part of the medulla were microscopically the site of extensive necrosis.

Three additional cases of radiation myelitis of the cervical spinal cord are also presented. These patients received a smaller dose to the cervical cord than the 7 above recorded received to the brain stem. The

symptoms tended to come on later, and did not progress to a fatal termination.

Boden refers to Strandqvist's paper giving graphs relating dose and over-all time for the production of the same biological effect. These curves have been used by the author to bring the various doses recorded as giving rise to brain and cord necrosis to a biologically equivalent dose in a standard time. The time chosen was seventeen days, because this was the over-all time at which the majority of the cases were treated. However, one can readily relate dosage to any desired time by using Strandqvist's graph.

Boden proposes the range of safe dose for irradiation of any part of the central nervous system from 3,500 to 4,500 r, according to the size of field used, delivered in seventeen days. Equivalent doses are from 3,650 to 4,700 r in twenty-one days, and from 3,900 to 5,000 r in twenty-eight days. These doses are calculated without regard to absorption in overlying bone.—*S. G. Henderson, M.D.*

Vannfält, Karl Axel. The roentgen treatment of bronchial asthma. *Acta med. Scandinav.*, 1950, *138*, 315–318.

The roentgen treatment of bronchial asthma was introduced in 1907 by Schilling, who found that asthmatic patients improved following fluoroscopy for diagnostic purposes. Since then various workers have reported 50–87 per cent of cases as being cured or improved following roentgen therapy.

Replies to a questionnaire were received from 68 of 106 patients who had had both medicinal and roentgen therapy. Patients with fever or severe acute asthma were not given roentgen therapy at all or were not given it until their general condition showed considerable improvement. Thirty-seven patients indicated that roentgen therapy was superior to medicinal therapy, 17 indicated equal response, and 14 reported roentgen treatment inferior.

The therapy was directed toward two anterior and two posterior hilar fields. As a rule 200–250 r in air times 3 was given in each series to each field, with copper or tin filter.

The material investigated did not support the theory that the therapeutic results are influenced by the condition of the lungs as evidenced by the roentgenograms, by diseases complicating the asthma or by the season during which the treatment was given. Nor did the age of the patients, the degree of severity of the disease, the sedimentation rate, the leukocyte count or the blood eosionphilia affect the results. Variations in the roentgen dose within the limits applied—1,000 to 3,250 r—were found to be without significance.

The best results of roentgen therapy of bronchial asthma were secured in cases of long duration. Statistically, however, it was impossible to prove that the duration of the disease was significant.

The duration of the cure or improvement resulting from the roentgen treatment was reported to be permanent in 7 cases (1 to 12 years), longer than one year but not permanent in 2 cases, six months to one year in 10 cases, and less than six months in 13 cases.—*Charles Nice, M.D.*

Lumb, George. Changes in carcinoma of the breast following irradiation. *Brit. J. Surg.*, July, 1950, *38*, 82–93.

Sixty cases of breast cancer were studied from which a total of 74 specimens were received. Some cases had multiple biopsies at varying dosage levels during treatment. In all cases the whole breast was studied following treatment. The treatment consisted of roentgen therapy only at 220 kv. The doses varied from 2,000 r to 4,000 r tumor dose administered in periods ranging from twenty to forty days.

The histopathological findings are reported in considerable detail with numerous photomicrographs. The authors group the changes under two headings: (*A*) cellular effects, and (*B*) connective tissue changes and replacement phenomena.

(*A*) The cellular effects were acute cell dissolution and alteration in cell structure. There was no evidence of differentiation such as is seen in squamous cell carcinoma. The alteration of cell structure consisted of nuclear changes ranging from pyknosis to vacuolation of the nucleus and cytoplasmic changes varying from vacuolation to cell rupture and formation of giant cells. Microscopic calcification was found in 50 per cent of the cases.

(*B*) The connective tissue changes were interpreted as replacement phenomena and were of two types: (1) thick strands of a cellular material resembling collagen but not staining characteristically; the author states that this type of tissue has not been reported previously; (2) masses of granular material which the author interprets as being degenerative in character.

The cases were divided into 5 groups according to dosage as follows: (1) less than 2,000 r, (2) 2,000 to 2,500 r, (3) 2,500 to 3,000 r, (4) 3,000 to 3,500 r and (5) 3,500 to 4,000 r. It was found that a dose below 2,000 r is ineffective. No cases receiving over 3,500 r showed unaltered cells.

The author concludes that a dose of over 3,500 r comes close to destroying the majority of breast cancers.—*G. M. Wyatt, M.D.*

Fugazzola, Franco. La radioterapia delle menometrorragie della pubertà e dell' età feconda. (Radiotherapy of menometrorrhagia in puberty and in the child-bearing period.) *Radiologia*, March-April, 1950, *6*, 241–253.

Essential menometrorrhagia in puberty and before the menopause is an endocrine imbalance usually involving the pituitary gland and the ovaries. The breast elaborates a hormone, increasing during lactation, which inhibits ovarian activity, increases uterine contractibility, and causes constriction of the

uterine arteries. Since secretion of this hormone is increased by roentgen exposure to the breast, the author treated 32 patients with this disorder by giving small doses of roentgen rays to the breast and also to the spleen. The spleen was included because of its important role in the phenomenon of coagulation.

An exact diagnosis was necessary to exclude any etiology other than an endocrine dysfunction. Every case had an endometrial biopsy to rule out cancer as well as to determine the condition of the endometrium. In only 3 cases was endometrial hyperplasia present.

The scheme of therapy was to give 100 r in air to one breast and to give a similar dose to the other breast after seven days. Rarely, a third treatment was given. After this, a similar course of treatment was given to the spleen. The technical factors were: 170 kv., 0.5 mm. Cu filter and a treatment distance of 40 cm.

In most of the cases, bleeding stopped or was reduced and the menstrual cycle showed improvement or became regular. Those cases which failed to respond or which showed recurrence of symptoms were given another cycle of treatments.

Other forms of therapy are discussed, including diathermy to the breast, thyroid and hypophysis, electrotherapy to the breast and uterus, roentgen irradiation of the pituitary gland, and roentgen and radium treatment of the uterus and ovaries. The author prefers his treatment to all of these because he believes it is more effective, does not cause sterility, does not produce undesirable symptoms or sequelae, and may be repeated if needed without danger.—*C. Colangelo, M.D.*

Orlandini, Ivo. Rilievi sulla roentgenterapia della tubercolosi genitale femminile in un decennio presso l'Istituto di Radiologia della Universitá di Parma. Studio clinico-statistico. (A ten year survey of the results of roentgen therapy in tuberculosis of the female genitalia treated at the Institute of Radiology of the University of Parma.) *Radiologia*, March-April, 1950, *6*, 263–277.

Tuberculosis of the female genitalia is an infrequent disease. In the order of frequency it involves: tubes, ovaries, uterus, vagina, and vulva. Many believe that genital tuberculosis represents a spread from tuberculous peritonitis and, in fact, the two conditions frequently coexist.

A large series of cases was treated during the years 1939–1949 at the University of Parma using roentgen therapy either alone or in conjunction with some type of surgery. The author includes 138 cases in the tables presented. Of these, about 80 per cent showed either clinical cure or improvement.

The general plan was to treat each case initially with doses of 50 to 60 r in air to both a large anterior and a large posterior pelvic port at the same session repeating the dose every two or three days until each port received a total of 200–300 r. The technical factors were: 150 kv., 3 ma., 0.5 mm. Zn plus 4 mm. Al filters and a treatment distance of 35 cm. Such doses are believed to stimulate the proliferation of connective tissue to the detriment of the tuberculosis. If subjective and objective improvement was obtained, the course was repeated after one to two months, but when improvement was not sustained or was negligible, treatment was given to produce temporary castration lasting for twelve to eighteen months. In such cases 175 r in air was delivered daily to one of four pelvic ports attempting to center over the ovarian area and rotating the ports until a total of twelve treatments had been given. The factors were the same except that 160 kv. was used rather than 150 kv.

This treatment was used in young females or in women in the child-bearing period who refused to permit permanent roentgen castration.

Permanent castration was effected in those patients who had extragenital tuberculosis which did not respond to treatment with small doses, in patients approaching the menopause who did not respond to small doses, and in young females who did not improve after temporary castration. Permanent castration was produced by a technique similar to that for temporary castration except that the daily dose was increased to 275 r.—*C. Colangelo, M.D.*

Czech, H., Kepp, R. K., and Wolthaus, G. Ergebnisse der Behandlung der bösartigen Genitaltumoren an der Universitäts-Frauenklinik Göttingen in den Jahren 1937–1944. (Results of treatment of malignant genital tumors in the Gynecologic Clinic of the University at Göttingen from 1937–1944.) *Strahlentherapie*, 1950, *82*, 321–354.

This paper brings up to date the treatment results from this clinic; their last report was published in June, 1942. The data presented are detailed and exhaustive. Their results in treatment of carcinoma of the uterine cervix are summarized below, but these isolated observations are extracted from additional parts of the paper:

Previously excellent follow-up studies were impaired by war and post-war conditions; patients lost to follow-up were counted as dead.

The importance of intracavitary irradiation for gynecologic therapy can no longer be considered debatable.

Cases of carcinoma of the uterine cervix can be classified into international Stages I and IV with reasonable uniformity, but difficulty exists in dividing cases between Stages II and III.

The treatment of choice for *carcinoma* of the *uterine corpus* is total excision of the uterus and adnexa. In cases counted inoperable because of local

spread of the tumor or because of the patient's general condition, intrauterine radium is the most important part of the radiation therapy.

Vaginal and *vulvar carcinomas* are no longer treated by radical surgery because of the high operative mortality and the low rate of cure. From 1937–1944, the five year cure rate in 50 cases of malignant vaginal tumor (49 were carcinoma, 1 was sarcoma) was 20 per cent; no mortality resulted from treatment itself. For vulvar carcinoma, the five year cure rate was 22.3 per cent in 36 cases.

Radical operation offers the best chances for cure in *ovarian* carcinoma. Of 102 cases previously untreated, this clinic's five year cure rate was 21.8 per cent. Transvaginal roentgen therapy is effective in treatment of tumor tissue in the pouch of Douglas. External irradiation should be administered to even the far advanced cases because unexpectedly favorable response frequently results (the authors state their impression that in these cases modern chemotherapy—without specifying hormonal or antibacterial chemotherapy—may be a worthwhile supplement to radiation therapy).

The value of irradiation with ultra-hard roentgen rays, fast electrons, or artificial radioactive substances is still to be determined.

Transvaginal roentgen therapy can be exploited to its maximum only by physicians experienced in gynecologic techniques *and* well-grounded in the rationale of radiation therapy.

Treatment of carcinoma of the uterine cervix is by radical operation (Wertheim or Schauta) and postoperative irradiation whenever feasible—largely in Stage I cases, but also in selected Stage II cases—otherwise by irradiation only. The main difference between the two periods contrasted, 1937–1942 vs. 1943–1944, was greater fractionation of radiation therapy and a greater total dose of radiation in the latter period. The five year cure rate for 704 previously untreated cases treated in the 1937–1942 period was 41.1 per cent and for 329 cases in the 1943–1944 period, 42.9 per cent.

Stage I (1937–1942) 191 patients of whom 107 were treated by operation and 84 by irradiation only; the five year cure rates were 67.3 per cent and 54.3 per cent respectively.

Stage I (1943–1944) 72 patients of whom 37 were treated by operation and 35 by irradiation only; the five year cure rates were 48.6 per cent and 62.8 per cent respectively. Because of the small number of patients, no definite conclusions can be drawn concerning the question of operation vs. radiation therapy alone.

Stage II (1937–1942) 211 patients of whom 10 were treated by operation and 201 by irradiation only; the five year cure rate was 48.3 per cent.

Stage II (1943–1944) 76 patients, all treated by irradiation only; the five year cure rate was 48.7 per cent.

Stage III (1937–1942) 291 patients with a five year cure rate of 23.4 per cent.

Stage III (1943–1944) 175 patients with a five year cure rate of 36.5 per cent.

Stage IV contained so few patients that comparison was not worth while. Of 18 patients, one was counted as a five year cure.

The mortality from radiation therapy for the entire period was 1.3 per cent (12 deaths in 888 cases): from 1937–1942, 0.8 per cent (5 deaths in 596 cases); from 1943–1944, 2.4 per cent (7 deaths in 292 cases). The mortality from operation in 1937–1942 was 2.8 per cent (3 deaths in 107 cases) and in 1943–1944, 5.4 per cent (2 deaths in 37 cases).—*H. G. Moehring, M.D.*

Heinke, E. Zur Radiumbehandlung der Papillomatosis der männlichen Harnröhre. (Radium treatment of papillomatosis of the male urethra.) *Strahlentherapie*, 1950, *82*, 383–386.

A thirty-six year old male developed papillomatosis of the urethra after repeated gonorrheal infections. Biopsy was not permitted. The condition responded well to two series of fractionated intraurethral radium treatments (3×150 r in three days, and after four weeks with similar fractionation 550 r to yield a total of 1,000 r). The radium was applied within a urethral catheter with eleven 2 mg. radium cells in tandem; the filtration was 1 mm. of platino-iridium. Follow-up period was two years.—*H. G. Moehring, M.D.*

Fuentes Ferrer, José J. Sarcoma del pene. (Sarcoma of the penis.) *Arch. Hosp. Universitario Habana*, May-June, 1950, *2*, 335–340.

The author has reviewed the world literature on tumors of the penis and found only 5 fibrosarcomas previously reported. To these he adds another case of a thirty year old man whose tumor presented itself as a nodule on the glans penis. A few months later it formed a cauliflower-like mass involving the prepuce and ulcerated in its center. In the treatment of this case the penis was amputated surgically and biopsy was made of enlarged inguinal lymph nodes. These proved to be inflammatory but postoperative roentgen therapy was administered to the stump of the penis and both inguinal regions. The author feels that such postoperative roentgen therapy should be applied in carcinoma of the penis as well.—*Norman Simon, M.D.*

McWhirter, R. Adnexal tumours. *J. Faculty of Radiologists*, July, 1950, *2*, 31–42.

Radiation therapy even more than surgery depends for success upon pathology,—that is, a knowledge of the precise nature of a tumor. The author suggests that for the purpose of classification certain tumors showing similar features on histopathological examination and which have a similar behavior in respect of rate of growth, mode of spread, radiosensi-

tivity and prognosis, might with advantage be grouped together and treated along similar lines.

The radiotherapist in association with his clinical colleagues and his colleagues in pathology is in a position to assist in the establishment of a classification of tumors based on histopathology but so modified that the classification takes into account and so denotes tumors with common features of clinical behavior, radiosensitivity and prognosis.

Rodent Ulcer. The essential feature distinguishing a simple tumor from a malignant tumor is the proportion of cells which undergo maturation. In the rodent ulcer the vast majority of the cells are uniform in appearance. Many of the cells of a rodent ulcer are differentiated. The differentiation occurs in attempts at the formation of hair shaft or sweat ducts of adult type and not toward squame formation. Because rodent ulcers appear to differentiate toward the appendages or adnexae of the skin, Foot has suggested the term "adnexal tumors." A subcutaneous type of rodent ulcer which has probably arisen from a deeply penetrating gland of hair follicle has been called a "Brooke's tumor."

Adamantinoma. Microscopically these tumors are similar to rodent ulcers of the skin. They are another example of tumors arising from squamous epithelium and differentiating toward primordial adnexal structures. These tumors are amenable to roentgen therapy and show a degree of sensitivity comparable to that found in rodent ulcers.

Carcinoma of the Maxillary Antrum. Some tumors of the maxillary antrum show histopathological features similar to those found in rodent ulcers and adamantinomas.

Nasopharyngeal Endothelioma. This tumor usually first makes its presence known by involvement of the oculomotor nerves. Roentgenographic examination shows destruction of the sphenoid sinus and of the dorsum sellae. Frequently no tumor mass is found in the nasopharynx and it rarely spreads to the lymph nodes. It is situated extradorsally and spreads out as a tumor pannus over the base of the skull, eroding and destroying it,—in later stages involving many of the cranial nerves. Destruction may involve the petrous apices and part of the sphenoid wings. The anterior lobe of the pituitary, like the dental lamina, arises from the ectoderm of the primitive oral cavity, the point of origin corresponding to the vomerosphenoidal junction. The anterior lobe of the pituitary is thus one of the adnexal structures derived from squamous epithelium, and the cells of the pituitary stalk, like the cells of the appendages of the skin and of the dental lamina, tend to lose their power to undergo squame formation and differentiate in the directions previously described. These tumors have been found to have a radiosensitivity corresponding to that of rodent ulcers.

Salivary Gland Tumor. They should not be called "mixed tumors." These are properly regarded as adenomas or adenocarcinomas. Most show appearance very similar to that found in rodent ulcers.

Bronchial adenomas show the same basic features of masses of close-packed, small and extremely regular epithelial cells, as found in the other rodent ulcers previously discussed.

In summary, the author says that certain tumors often regarded in the past as quite separate and distinct appear to be identical, not only in histopathological appearance but also in their clinical behavior, and in particular in their absence of spread to the lymph nodes, their slow rate of growth, their radiosensitivity, and their prognosis. This group of lesions may properly be called "adnexal tumors."—*S. G. Henderson, M.D.*

Johnson, Richard E., and Ackerman, Lauren V. Epidermoid carcinoma of the hand. *Cancer*, July, 1950, *3*, 657–666.

Seventy-one cases are analyzed. All were located on the dorsum of hands, fingers, and forearm; almost always the patient was an outdoor worker, usually male. Median age was seventy-four years. Fifty-seven per cent was the three year cure rate. Frequency of metastases was 15 per cent.

Histopathologically, a tumor extending below the sweat glands was found to be clinically fixed to the underlying fascia. These were more apt to metastasize. Previous inadequate treatment is another important factor influencing the rate of metastasis. The size of the tumor and the degree of differentiation also seemed factors influencing the rate of metastasis.

Metastasis was almost always to the axillary lymph nodes; occasionally the epitrochlear lymph nodes were involved.

Amputation is performed only for far advanced carcinoma. Surgery seems preferable to roentgen therapy, and wide surgical excision with skin grafting appears the accepted method.—*R. C. Datzman, M.D.*

Wiley, Horace M., and Sugarbaker, Everett D. Roentgenotherapeutic changes in the small intestine; surgical aspects. *Cancer*, July, 1950, *3*, 629–640.

Severe roentgen therapeutic damage to the small intestine was encountered in 9 cases out of 600 patients treated by roentgen therapy for carcinoma of the uterus. The average time elapsing between radiation treatment and the development of incapacitating symptoms was twenty-six and a half months.

All but 2 cases reached a stage of partial or complete intestinal obstruction. Factitial reaction to the small bowel seemed to occur only in small thin women as a result of more effective depth doses of radiation on the lower small bowel. These patients return from five to sixty months later with tarry or bloody stools, anorexia, episodes of abdominal cramping and distention, vomiting, diarrhea, marked weight loss, and anemia. The differentiation of this syndrome from recurrent or metastatic carcinoma is

aided by the finding of a factitial proctitis. A small bowel roentgenographic series or barium enema shows a picture similar to regional ileitis with ileal narrowing in some areas and dilated loops with puddling of barium in others.

The pathology involves only those segments of small intestine that had sufficiently long mesentery to allow them to enter the pelvic zone of irradiation. The rectum, sigmoid, and cecum are also frequently involved. The peritoneum is lusterless and thickened. Obstruction usually involves the distal ileum. The injured bowel is thickened, edematous, inflexible, telangiectatic, and avascular. Fixation of loops in the pelvis with mucosal ulceration, necrosis, perforation and peritonitis is often found. There is fibrosis and scarring of the bowel wall which may be marked enough to cause stricture. These changes produce chronic bleeding and impaired absorption resulting in progressive anemia and malnutrition.

Seven patients required surgical intervention, chiefly for obstruction. The authors advise preoperative transfusions, Miller-Abbott tube decompression, followed by simple side-tracking anastomosis between healthy loops of intestine. The Mickulicz double barrel ileocolostomy is the procedure most frequently used and offers the advantages of extraperitoneal anastomosis, putting the large bowel at rest, and immediate decompression. Resection of the damaged bowel is usually contraindicated because of the poor condition of the patient. Six of the 9 patients died, and the 4 upon whom autopsies were done showed no residual carcinoma. Two are living seven months and six years following surgery. One is still being treated medically.

This report is recommended to all radiotherapists. —*J. A. Campbell, M.D.*

RADIOIOSOTOPES

Levi, J. Elliot, and Lewison, Edward F. Venous velocity in the leg measured with radioactive sodium. *Bull. Johns Hopkins Hosp.*, June, 1950, *86*, 370–382.

This is a study of segmental linear venous velocity in the leg in 40 subjects regarded as normal. A detailed description of the technique used is given. Briefly, it consisted of injecting 0.1 to 0.2 cc. of radioactive sodium 24 in a hypertonic solution of pH 7.0 which amounted to a total dose of not more than 75 microcuries. This was considered to be within the range of the accepted tolerance dose of 0.1 r daily continuous total body irradiation. The injection was made into the greater saphenous vein adjacent to the medial malleolus, and a Geiger-Müller tube held in place over the fossa ovalis recorded the arrival of the radioactive sodium at this point. The mean linear venous velocity was found to be 3.8 ± 0.37 cm. per second with extremes ranging from 1.3–13.0 cm. per second.

A comparison with other studies is given. The serious problem of venous thrombosis is also discussed.—*J. J. Wiesner, M.D.*

Lawrence, John H., and Wasserman, Louis R. Multiple myeloma: a study of 24 patients treated with radioactive isotopes (P^{32} and Sr^{89}). *Ann. Int. Med.*, July, 1950, *33*, 41–55.

As an introduction, the authors briefly review the literature in regard to the present status of the various methods (roentgen therapy, stilbamidine, urethane and P^{32}) used for the treatment of multiple myeloma and give a short résumé of the most important features of the disease.

Their own experience includes treatment with radioactive phosphorus (P^{32}) and radioactive strontium (Sr^{89}) or a combination of both. The first attempts to use artificially radioactive isotopes in multiple myeloma were made by the authors in 1939 and preliminary reports were published in 1941 and 1942. In the present article the results of all 24 patients (14 men and 10 women) observed since 1939 are summarized.

The pertinent clinical data in the individual cases, the data of the hematologic examinations and the detailed dose schedules are presented in tabular form.

The P^{32} results in wide distribution throughout the whole body, the initial concentration being chiefly in the liver, bone marrow and tumor tissue and the subsequent deposition occurring in the bony skeleton. The Sr^{89} behaves similarly to calcium. It was realized from the beginning that because of the danger of producing damage to the normal hemopoietic bone marrow the proper dosage had to be determined with great care.

Of the 24 patients, 15 had previous roentgen therapy. Anemia was present in 11 patients before the isotope therapy was started and in 10 patients it developed while they were under treatment. Leukopenia was noted in 4 patients prior to the therapy and in 3 additional patients during treatment with P^{32}.

Of the entire group, 21 patients were treated with radioactive isotopes: 9 with combined P^{32} and Sr^{89}, 11 with P^{32} alone and 1 with colloidal radioactive yttrium (Y^{90}).

A compilation of the results showed that 7 patients were not benefited either because they were in a very advanced stage of the disease (5) or had severe anemia (2); the 1 case treated with Y^{90} likewise was not benefited; in 8 other patients the benefit was questionable, and in 5 patients the results were relatively satisfactory. In the group of patients who are now dead, the survival ranged from six months to nine years, the average length of life from onset of the disease being approximately three years. This is slightly longer than reported in previous series.

The dosage depends on the general condition of the patient and the hemogram. For P^{32} 1 mc., given intravenously, once or twice a week up to a total of 5–

10 mc. is suggested per course, which may be repeated after an interval of three to four months. The Sr^{89} was usually administered in association with P^{32} (in doses of 0.2–2.0 mc.) and therefore its optimal dose cannot be estimated as yet. There was no evidence that the combination of Sr^{89} and P^{32} proved more effective than P^{32} alone. The Y^{90} was given in individual doses of 3–4 mc. reaching a total dose of 10 mc. in twenty-two days.

The conclusion is reached that these isotopes are valuable in producing whole body background irradiation; therefore, their use in conjunction with other therapeutic agents, such as roentgen rays, stilbamidine and urethane, is recommended in multiple myeloma.—*T. Leucutia, M.D.*

Burstone, M. S. The effect of radioactive phosphorus upon the development of the teeth and mandibular joint of the mouse. *J. Am. Dent. A.*, July, 1950, *41*, 1–18.

Prior to this report, no histopathologic studies of the teeth and their supporting structures following the administration of radiophosphorus were carried out. The authors administered from 5 to 60 microcuries of P^{32} per gram of body weight subcutaneously to mice, two to ten days old. At specified time intervals, the injected animals, together with controls, were sacrificed.

The teeth showed disturbances of osteogenesis or odontogenesis, or both. Doses of 15 to 60 microcuries per gram produced cessation of histodifferentiation of new ameloblasts. Those present toward the root portion of the crown appeared as low cuboidal or squamous cells. Older odontoblasts toward the coronal portion of the tooth appeared unchanged, but the newly differentiated ones at the root portions appeared as spindle cells with cytoplasmic processes. These cells were associated with osteodentin formation. Animals surviving more than two weeks showed cessation of morphodifferentiation of the root structure. Odontoblasts were more radiosensitive than ameloblasts. Offspring of pregnant mice showed the most marked changes.

Concerning the mandible, doses of 10 to 60 microcuries per gram produced marrow hyperplasia of the alveolar bone; 15 to 60 microcuries per gram caused decreased osteoblastic activity, with the formation of immature fibrillar bone.

Ossification and calcification of the mandibular condyles were inhibited. Marrow aplasia, subcartilage linkage, and decreased osteoblastic activity with poor trabecular formation were present. The interarticular disk was radioresistant. The areas of the cartilage cap exhibiting a decreasing radiosensitivity (in order) were: zone of erosion, hypertrophic zone, intermediate zone, and embryonic zone. The author concludes that the effect of beta irradiation upon the teeth and jaws is similar to that of roentgen irradiation. The article contains good photomicrographs showing these changes.—*O. M. Weaver, Jr., M.D.*

Kearns, John E., and Hutson, William F. Radioactive iodine in the treatment of hyperthyroidism. *Quart. Bull., Northwestern Univ. M. School*, 1950, *24*, 107–110.

The isotope, I^{131}, has a half-life of approximately eight days, and at the end of a month most of the activity has been dissipated. The danger of late tissue effects is therefore minimal. I^{131} is concentrated in the thyroid in amounts 10,000 times greater than in the blood or in any other organ. The roentgen equivalents delivered to a 50 gram thyroid with approximately 80 per cent "uptake," with a dose of 4 millicuries of radioiodine is about 6,000 roentgens. Thirty patients with hyperthyroidism have been treated with I^{131} during the past two and a half years. This type of treatment is considered "another satisfactory method of treatment for hyperthyroidism which carries no morbidity, no mortality, and no hospitalization of the patient." Recurrences have been noted in about the same ratio as in other reported series.—*C. N. Borman, M.D.*

Oddie, T. H., and Scott, R. Kaye. Results of uptake and excretion tests with radio-iodine. *Brit. J. Radiol.*, June, 1950, *23*, 348–354.

It is generally agreed that the condition of the human thyroid gland determines its behavior toward small amounts of iodine. The amounts administered, excreted and retained in the thyroid can be determined with considerable accuracy. The authors have made careful measurements of these amounts as well as of the rate of change constants concerned with the assimilation and metabolism of iodine.

Previously curves representing the percentage of acceptance (or excretion) versus time have been adopted as satisfactory criteria for estimating gland function. The authors disagree with this. The initial uptake rate varies widely. The rate of excretion is about constant for most cases, but it might be of value in showing abnormal kidney conditions.

The most valuable figure is the rate of transfer of organic iodine from the gland. Using this factor, the authors were able to predict the degree of toxicity or lack of it in 17 out of 19 cases. Using other published methods of analysis, the error in prediction of the condition of the thyroid gland was much greater. This rate of transfer in the case of hypothyroidism is very low or zero, and cannot be used as a criterion.—*E. F. Lang, M.D.*

Weinberg, S. J., Fink, R. M., Fink, Kay, and Packer, G. L. Metastatic adenocarcinoma of the thyroid with elevated basal metabolism: radioiodine studies. *Ann. Int. Med.*, June, 1950, *32*, 1207–1224.

This is a detailed report on one patient with autopsy. The author quotes Marinelli as stating that approximately 15 per cent of thyroid cancers may be expected to accumulate radioactive iodine to some degree. The patient reported had an adenocarcinoma of the thyroid, with known metastases in the liver. The subject was unusual, in that he also exhibited evidence of hyperthyroidism. At autopsy, no therapeutically effective concentrations of radioiodine could be demonstrated in the metastases.—*E. A. Addington, M.D.*

McCullagh, E. P., Gold, A., and McKendry, J. B. R. Radioactive iodine uptake in the hypermetabolism of acromegaly. *J. Clin. Endocrinol.*, July, 1950, *10*, 687–691.

Certain manifestations of hyperthyroidism, including tachycardia, goiter and increased oxygen consumption, are also found in some cases of acromegaly. Over 50 per cent of patients with acromegaly will be found to have basal metabolic rates above normal.

This hypermetabolism is most easily explained on the basis of excessive thyrotropin secretion by the pituitary.

The authors studied 7 cases of acromegaly with tracer doses of I^{131}. All of the cases had elevated basal metabolic rates. They found the uptake of I^{131} by the thyroid gland of these patients to be low or normal and feel that it is further evidence for the existence of an extrathyroidal metabolic stimulus in acromegaly.—*R. A. Hays, M.D.*

Bohr, Hans, and Sørensen, August Halborg. Study of fracture healing by means of radioactive tracers. *J. Bone & Joint Surg.*, July, 1950, *32-A*, 567–574.

One of the numerous problems connected with healing of fractures is that of whether the processes involved are purely local—that is, limited to the fracture itself and the tissues immediately about it—or whether the whole skeletal system is affected. The authors quote Roche and Mourgue who concluded that the entire skeletal system acts as a unit and that local influences can be traced throughout the skeleton. In the investigation reported in this paper, an attempt was made to follow the changes in a fractured bone as well as the possible effect of the fracture on the intact part of the skeleton. Radiophosphorus and radiocalcium were used as tracers.

The experiments and results are given in detail in the paper. The authors conclude that their experiments on rats with radiophosphorus and radiocalcium, administered at different periods during the healing of fractures, showed increased activity of the bone ash from the fractured bone as compared with the ash from homologous intact bone of the same animal. Further investigations indicated that this effect is due mostly to an increased exchange of phosphorus and calcium between the plasma and the mineral substance of the bone. Measurements of the separated epiphysis indicate that this process involves the whole bone and the proximal epiphysis of the tibia as well. By applying their results to the work of Roche and Mourgue, they were unable to confirm that the processes taking part in the healing of a fracture can also be found in the skeleton as a whole.—*R. S. Bromer, M.D.*

Twombly, Gray H., and Schoenewaldt, Erwin F. The metabolism of radioactive dibromoestrone in man. *Cancer*, July, 1950, *3*, 601–607.

Dibromoestrone labeled with Br^{82} was injected into 11 patients. In 8 of these patients drainage tubes were inserted into the common bile duct for drainage purposes. In the remaining patients, operations (radical mastectomy, hysterectomy) were performed twelve hours after the administration of the steroid. It was found that the biliary system was the principal route of excretion of the steroid, 39 per cent through this route and only 18 per cent in the urine. There was no evidence of selective localization in the breast or uterus.—*J. G. Lorman, M.D.*

Wainwright, William Ward, and Lemoine, Frank A. Rapid diffuse penetration of intact enamel and dentin by carbon^{14}-labeled urea. *J. Am. Dent. A.*, Aug., 1950, *41*, 135–145.

The recent demonstration of an apparent caries-inhibiting effect of urea has made investigations of its enamel-penetrating properties worthy of study. Radioactive urea labeled with C^{14}, in a dilute solution with a specific activity of 924 microcuries per milliliter, was painted over the crown surface of 14 recently extracted teeth. Radioautographs of tooth sections made approximately twenty-four hours after painting showed diffuse penetration of intact enamel by radioactive material. In some specimens, there was also penetration through the enamel into the dentin, and in 4 there was penetration into the pulp.—*H. P. Brean, M.D.*

Gray, Seymour J., and Sterling, Kenneth. Determination of circulating red cell volume by radioactive chromium. *Science*, Aug. 11, 1950, *112*, 179–180.

Previously, radioactive iron and phosphorus had been used as agents in the determination of the circulating red blood cell volume. The disadvantages of each prompted the authors to study a new isotope, chromium 51, with a half-life of 26.5 days.

The red cells avidly take up the isotope when it is added to the blood in vitro as $Na_2Cr^{51}O_4$; there is no significant loss of radioactivity by the red cells over a period of twenty-four hours. This is an advantage over the phosphorus method where the exchange of the phosphate between the red cell and plasma causes

a fall in radioactivity in the cells in one to three hours.

The method used by the authors involved the removal of 50 ml. of blood from a dog and heparinization. The isotope Cr^{51} was added and after an hour the red cells were washed and resuspended in plasma from the same dog. An aliquot was removed for counting and the remainder injected into the dog. Small amounts were removed at intervals from ten minutes to twenty-four hours.

The samples were centrifuged and the cells dried over night.

The radioactivity in the dried cells was counted.

The circulating red cell volume of the animal is given by the formula:

$$\text{Red cell volume in ml.} = \frac{\text{Total counts injected}}{\text{Counts per ml. packed red cells in sample}}$$

The numerator of this fraction is obtained from the counts per ml. of packed red cells, the volume of whole blood injected and the hematocrit.—*R. A. Hays, M.D.*

Coliez, Robert. L'emploi du cobalt 60 en curietherapie. (The use of cobalt 60 in radium therapy.) *J. de radiol. et d'électrol.*, 1949, *30*, 518–524.

This lengthy paper discusses all aspects of the use of cobalt 60 in curietherapy. The article concerns itself primarily with the use of this radioactive isotope in telecurietherapy. The nuclear physics involved in the production of cobalt 60 is reviewed; the arrangement of cobalt 60 in small needles and in tubes, as in the case of radium, is diagrammed, as well as the apparatus for multifocal telecobalt therapy. Considerable detailed information is given concerning the physical characteristics, construction and economic cost of a cobalt bomb for treatment by telecobalt therapy with four fixed fields. A diagram of this is given for use in treatment at the level of the uterus and parametrial areas. Each of the four fields, as this apparatus is constructed, is approximately equal to 300 grams of radium. It is quite certain that perhaps the most important use of cobalt 60 will be its use in large quantities, the method being similar to the teleradium installations presently employed. As the author of this article points out, this should allow the use of a beam of extreme intensity and great flexibility.—*W. M. Loehr, M.D.*

Freundlich, H. F., Haybittle, J. L., and Quick, R. S. Radio-iridium teletherapy. *Acta radiol.*, July-Aug., 1950, *34*, 115–128.

Co^{60} has been thought to be a good substitute for radium because of its long half-life and its convenient mechanical and chemical properties. It may be used for interstitial treatments, surface application or as a source for teletherapeutic units. However, for the latter application, very strong sources are required and unless a rather large neutron flux is available it would take a year or more to activate sufficient cobalt for teletherapeutic units. This is true because of the comparatively small neutron capture cross-section of Co^{59} and the long half-life of Co^{60}. It therefore seemed justifiable to investigate the possibilities of other radioactive isotopes which might be equally suitable and yield within a shorter period activities adequate, not only to replace the normal type of teleradium unit, but even to obtain outputs and depth doses comparable to 200–250 kv. roentgen therapy apparatus.

Radioactive isotopes to be used in a teletherapeutic unit should include the following advantages: (1) cheapness and availability; (2) the half-life should be long enough to insure continuous service without undue complications; (3) the slow neutron capture cross-section should be large enough to produce adequate specific activities in a flux of 5×10 neutrons/cm./sec.; (4) the mean energy of the emitted γ-rays should be above 300 kv. to obtain the minimum of selective absorption in different types of tissue.

Going through the four specifications laid down, iridium certainly fulfills condition (1). With regard to condition (2) it is quite feasible to achieve a continuous service with two identical sources per unit, one in use, the second being reactivated in the pile at the same time. After a month both sources are exchanged. Source No. 2 is used in the therapeutic unit, Source No. 1 is reactivated in the pile. During the month in use an Ir^{192} source decays by about 25 per cent. This fact can be taken into account when calculating the appropriate treatment time.

With regard to condition (3) the larger cross-section of iridium is the main advantage of using iridium in preference to cobalt. Condition (4) is certainly fulfilled as the mean energy of the emitted γ-rays is about 0.4 Mev.

Taking all these facts together, the authors thought it worth while proceeding with the actual construction of a teletherapeutic unit using Ir^{192} as the source of γ-radiation. Details of this construction are described as well as the physical measurements.—*Mary Frances Vastine, M.D.*

CHEMOTHERAPY

García López, G., Spies, T. D., Milanés, F., Lopéz Toca, R., and Reboredo, A. Ensayos clinicos con ACTH y cortisone. (Clinical trial with ACTH and cortisone.) *Arch. Hosp. Universitario Habana*, May-June, 1950, *2*, 247–277.

The authors report the use of cortisone and ACTH in 3 cases of leukemia, 1 case of Hodgkin's disease, 1 case of metastatic lymphoepithelioma, and five cases of arthritis.

ACTH and cortisone are found equally effective and they are useful drugs in the above conditions, but they are not curative.

An interesting observation was made in the patient with Hodgkin's disease. Two years after onset of his disease the patient had intense itching, abdominal masses, and peripheral lymph node enlargement. At this time he was given cortisone and on the second day of cortisone treatment the itching began to subside. After one week of this treatment his itching had completely disappeared. The masses regressed concomitantly.—*Norman Simon, M.D.*

Stickney, J. M., Heck, F. J., and Watkins, C. H. Cortisone and ACTH in the management of leukemia and lymphoblastoma. *Proc. Staff Meet., Mayo Clin.*, Aug. 16, 1950, *25*, 488–489.

Cortisone acetate and ACTH were given to 18 patients with acute leukemia. The response compared favorably with response to folic acid antagonists. Initially 3 patients showed complete and 2 showed partial remissions, but at the time of last report only 3 of the 18 were alive.

Three patients with chronic lymphocytic leukemia were given one or more courses of cortisone. Leukemia cutis of 1 patient was kept under control three months after a course of 2 gm. The spleen, liver and lymph nodes regressed for ten to twenty days each time after first and second courses.

Three patients with Hodgkin's disease received cortisone. Regression occurred for fifteen to thirty days per course. No significant blood changes occurred.

When possible the hormone was administered continuously for twenty to thirty days in one course. Side effects included rapid gain in weight, cardiac enlargement, edema, leukopenia, hypopotassemia and in 1 patient steroid diabetes. No hypertension, euphoria or mental depression occurred. Acne and rounding of the face were observed frequently.—*John Turner, M.D.*

Spies, T. D., Stone, R. E., Lopez, G. G., Milanes, Fernando, Toca, R. L., and Reboredo, Alfredo. Response to adrenocorticotropic hormone and cortisone in persons with carcinoma, leukaemia, and lymphosarcoma. *Lancet*, Aug. 12, 1950, *2*, 241–244.

Three patients with inoperable squamous carcinoma, 5 with acute leukemia, and 2 with lymphosarcoma were given either pituitary ACTH or synthetic cortisone acetate. The author states that in 9 of the 10 cases the symptoms were promptly ameliorated but the improvement was of short duration. The best result and most sustained effects were obtained in the 2 patients with lymphosarcoma with rapid decrease in the size of the involved lymph nodes and symptomatic improvement of from three to six weeks. With recurrence of symptoms, the dose was repeated and the beneficial effects were again obtained.

The authors do not believe that the clinical use of these substances is going to be of much aid in therapy but they do point out that these hormones represent a tool by which the metabolism of different tumors and different individual patients may be studied. The authors feel that questions regarding the abnormal physiology of the tumors may be unraveled by means of some methods such as they propose of using hormones to study the response of tumors to a constant change in environment which the hormones appear to produce.—*R. P. Barden, M.D.*

Swan, M. M., and Zelman, Samuel. Myelokentric acid in the treatment of acute lymphoblastic leukemia. *Ann. Int. Med.*, Aug., 1950, *33*, 438–442.

Myelokentric acid is a specific substance found in the urine of patients with myeloid leukemia, chronic forms of lymphoid leukemia, and Hodgkins' disease. An extract, representing 100 times the original urine concentration, has been used in the treatment of acute lymphoblastic leukemia.

Swan and Zelman report on the treatment of one such case, a twenty-five year old white male. Treatment was for thirty two days, until the supply ceased with the death of the donor. The usual dosage was an intramuscular injection of 5 cc. twice daily.

A hematologic remission occurred. Totals of lymphoid cells were less affected. The erythrocytes and platelets were unaffected. Clinical remission was not produced, although the clinical course of the disease may have been prolonged.

At postmortem examination, a pleomorphic leukemic infiltrate was found, conforming to previously reported cases.—*A. A. Brewer, M.D.*

Gardini, Giovanni F., and Tori, Giulio. Esperienze cliniche sulla iprite azotata. (Clinical experience with nitrogen mustard.) *Radiol. clin.*, July, 1950, *19*, 209–238.

Previously the authors reported the immediate results obtained with nitrogen mustard therapy in 13 cases of malignant neoplasms of the lymphatic and hematopoietic systems and of certain epithelial tumors. In the present article, they review those results after a longer interval and add a new group of 16 cases, thus making a total of 29 cases studied.

The authors used the HN_2 (methyl-bis [B-chlorethyl] amine hydrochloride), supplied by the Ciba firm. A dose of 0.1 mg. per 1 kg. body weight was given first daily and then every three to four days to prevent too much reaction. A course usually consisted of four or five injections, the total dose varying between 20 and 40 mg. Lately, this total dose was spread over a period of two to three weeks, and frequently associated with roentgen therapy which was

given in the intervals between the injections.

The distribution of the 29 cases was as follows: Hodgkin's disease, 11; reticuloendothelioma, 5; cancer of the lung, 5; pulmonary metastasis from seminoma, 2; lymphosarcoma, 1; round cell sarcoma, 1; multiple myeloma, 1; myelogenous leukemia, 1; lymphatic leukemia, 1; carcinomatosis, 1. The clinical records of all 29 cases are presented in brief résumés, and in several of them the roentgenograms of the patient showing the condition before and after treatment are reproduced. In the majority of instances the disease was far advanced. In 19 cases the nitrogen mustard therapy was used as the sole method; in the remaining 10, it was combined with roentgen therapy.

The authors arrived at the conclusion that (1) nitrogen mustard therapy should be tried in certain malignant affections and neoplasms which are of a general rather than local nature and particularly in lesions of mesenchymal origin; (2) the method is indicated in the cases which have become radiation fast; (3) it is also indicated whenever the skin cannot tolerate further irradiation; (4) a combination of nitrogen mustard and roentgen therapy is of definite value and is therefore recommended even in the earlier stages of the aforementioned conditions.—*T. Leucutia, M.D.*

Goldeck, Hans. Stilbamidinanwendung bei generalisiertem Plasmocytom. (Use of stilbamidine in generalized plasmocytoma). *Klin. Wchnschr.*, June 15, 1950, *28*, 399–401.

The author treated a case of multiple plasmocytoma with stilbamidine according to the procedure of Snapper.

The case, that of a man aged sixty-one, is presented in a brief résumé; the dosage and the essential laboratory findings are tabulated. The patient remained hospitalized for a period of nine months, until his death. During this preiod he received two series of the stilbamidine therapy, the first consisting of doses of 50–150 mg., given every other day intravenously up to 1.35 gm., and the second three weeks later of 100–150 mg. every second day up to 1.50 gm.

The following observations were made: the severe pain so characteristic of this disease was not relieved; the clinical course likewise remained uninfluenced; the anemia and especially the hyper- and dysproteinemia showed no positive response; the intravital appearance of basophil precipitates of ribonucleoproteids in the cytoplasma of the plasma cells as described by Snapper was, however, confirmed.—*T. Leucutia, M.D.*

MISCELLANEOUS

Morgan, Russell H. New trends in radiographic screening technics utilizing Schmidt optical systems and high-speed development. *Radiology*, July, 1950, *55*, 97–100.

Economic factors in present day and future practice of radiology are discussed.

Evolution of techniques and apparatus has resulted in increased cost to the patient and loss of close clinical contact between the radiologist, the patient, and the clinician.

Photofluorography is suggested as a probable solution to both these problems. Cost to the patient is appreciably lower, and, provided the radiologist follows his apparatus to the ward, his contact with his clinical colleagues is enhanced.

In recent years the use of Schmidt optics of the reflector type has permitted a decrease in the exposure of the patient to radiation so that now the photofluorographic apparatus delivers little more radiation than conventional roentgenographic equipment.

At present, clarity and quality of photofluorographic films are inferior to conventional roentgenograms, but improvement in resolution of photofluorographic lenses promises to overcome this disadvantage. Further developments in the field of rapid film processing may be expected to yield further benefit.—*A. W. Sommer, M.D.*

Rawlins, F. I. G. The intensification of the fluorescent image in radiology. *Proc. Roy. Soc. Med.*, June, 1950, *43*, 411–412.

The efficiency of the fluorescent screen in converting roentgen radiation into visible light is of the order of 3–4 per cent. It therefore follows that a "perfect" screen would enhance the brightness level only about 33 times. For practical purposes, however, image intensification of several hundred times is necessary; therefore, the energy of intensification must come from an outside source. Two such systems for image intensification are briefly mentioned (not described).

This paper will be published in extenso in the *British Journal of Radiology*.—*D. R. Bernhardt, M.D.*

Levene, George, and Perkins, Charles B. A new type of x-ray cassette cabinet. *Radiology*, July, 1950, *55*, 101–103.

A new type of cassette cabinet is described. The lead-lined cabinet permits storing of cassettes horizontally on individual roller-type racks. Cabinet space beneath the cassette storage area is suitable for storing of accessories.

Convenience, simplicity, compactness, and ease of construction are desirable features. Increase in cassette life is claimed.—*A. W. Sommer, M.D.*

Fitzgerald, Gordon M. Dental roentgenography. IV. The voltage factor (kv. p.). *J. Am. Dent. A.*, July, 1950, *41*, 19–28.

The author has written an excellent précis of the various technical considerations in producing a roent-

genogram of good quality. Because low kilovoltages are used, many dental roentgenograms are underexposed, and no practical increase in milliamperes can compensate for the resultant inadequate penetration. Shorter wavelengths produced by higher kilovoltages permit adequate penetration, and provide a long scale contrast range on the roentgenogram. High kilovoltage also permits the use of a smaller focal spot and a longer target-film distance. By decreasing secondary radiation fog, these factors will increase detail by decreasing beam size and by permitting the use of longer cones. Of course, both factors inherently demand higher kilovoltage with other factors held constant. Inasmuch as absorption is more dependent upon specific gravity than atomic number with high kilovoltage, it is to be recommended for dental use, where the extreme degrees of thickness in the various structures demand more uniform absorption in order to record slight density differences in all of the various tissues. Using higher kilovoltage, the line of demarcation at the dentino-enamel junction is better visualized, and the difference in density between the roots and the alveolar bone shadows is decreased.

The author criticizes the lack of fine kilovoltage controls and the low intensity output of the "modern" roentgenographic units. Future machines should provide high kilovoltage (100 kv. p. rating) for adequate penetration, regardless of density thickness or cone distance. Inasmuch as small changes in kilovoltage produce wide changes in density, adequate tissue differentiation demands a finely controlled kilovoltage range. A small focal spot area would contribute to detail sharpness.—*O. M. Weaver, Jr., M.D.*

Adolph, William, and Taplin, George V. Use of micropulverized barium sulfate in x-ray diagnosis; preliminary report. *Radiology*, June, 1950, *54*, 878–883.

After showing that micropulverizing barium sulfate by wet grinding in a ball mill for several days does not increase the toxicity, a water suspension of this material was used in various gastrointestinal studies. The micropulverized barium sulfate used had a surface mean diameter of 2.9 microns as compared to 5.3 microns for standard preparations. In using a micropulverized barium for colon examinations, better mucosal pattern of postevacuation roentgenograms was noted with larger areas of the mucosal outline, and the appendix was filled more frequently. This is a preliminary report and investigation of double contrast methods is planned.—*M. B. Goodwin, M.D.*

Muller, H. J. Radiation damage to the genetic material. Part II. Effects manifested mainly in the exposed individuals. *Am. Scientist*, July, 1950, *38*, 399–425.

Induction of Gene Mutations in Somatic Cells. In the cells of the body, the somatic cells, mutations of the genes are produced by radiation just as they are in germ cells, and with approximately the same frequency, for a given dose. Most mutations are recessive and not many can be found except those which happen to occur in the single X chromosome of a male and which therefore have no dominant normal gene to counteract their effects.

An occasional mutation occurs in a cell still capable of repeated division and happens to be a type that gives the cell containing it the property of more extensive growth than its neighboring normal cells possess. In this way an overgrowth might be produced. This is the basis for the somatic mutation interpretation of some cancers and leukemias. Mutant cells may have to wait many yeears after exposure to radiation before the effects of the induced mutations become visibly expressed. Thus, cancers induced by overexposure of a part of the body to irradiation often fail to show up until some ten to twenty years after the cessation of the irradiation.

Chromosome Breakage by Radiation, and Its Effects. Another kind of change produced in genetic material by radiation is breakage of the chromosomes. Experimental evidence indicates that in a given bulk of mammalian chromosome material, effective breakages are produced by a given dose of roentgen rays with a frequency similar to that occurring in an equal bulk of *Drosophila* chromosome material. Exactly the same type of result is produced in somatic cells as in germ cells. When a chromosome has broken, the broken ends have the property of being able to adhere to one another when they come in contact. If broken ends find one another the original chromosome will then be restituted in undamaged condition. However, if a chromosome has been broken shortly before its splitting, the broken ends may not manage to meet one another and in some instances two double pieces are formed, one of which carries two centromeres, "dicentric," the other no centromere, "acentric." These commonly fail to be incorporated in either daughter nucleus in the process of cell division. Such a loss of an entire chromosome with its cargo of genes is damaging to the cell.

The frequency of chromosome breakage in cases of chromosome loss caused by single breakage is found to be linearly proportional to the total dose of radiation just as the frequency of gene mutation is. This implies that they are also independent of the timing of the exposure, whether concentrated, protracted, or fractionated, provided equally sensitive stages have been irradiated.

When two breaks occur in different chromosomes its results is termed translocation, forming mosaic chromosomes. This causes even greater cell abnormality and a greater likelihood of death of the descendant cells. If the cell is a functional germ cell rather than a somatic cell the resulting embryo will die at an early stage. If fragmented chromosomes unite so that each centric piece unites with an acentric piece, each chromosome will come to have one

centromere, and so it will enter the daughter nuclei regularly, and the daughter nucleus will get the whole normal outfit of genetic material although in a new arrangement. In this type of translocated chromosomes produced in germ cells, the resulting first generation of offspring will be normal. However, when these offspring mature to form germ cells for the second generation, the translocated chromosome parts, failing to become lined up appropriately with the corresponding parts of the non-translocated homologous chromosomes, will in approximately 50 per cent of the maturing germ cells become improperly distributed among the daughter cells that develop into mature spermatozoa or eggs. The second generation of offspring derived from these abnormal germ cells usually die during some embryonic stage.

In human or other primate population, this condition would not tend to die out rapidly in consequence of the 50 per cent lowered fertility which it entails. In these species the termination of pregnancy would be followed, in compensatory fashion, by a new sexual cycle and in man himself there would, in addition, be purposeful attempts to effect compensatory conceptions. That the risk of this kind of hereditary damage may be appreciable is indicated by the fact that in mice it takes an exposure of spermatozoa to only 150 r to result in about 10 per cent of the surviving progeny's carrying these translocations.

Qualifications of translocations of chromosomes discussed brings out the fact that at a relatively high intensity of irradiation more than two breaks become available for cross-union with one another, and the translocation frequency is proportional to the square of the amount of radiation achieved within the effective interval multiplied by the number of such intervals over which the dose was applied.

The author estimates, provisionally, that the proportionality rule would become effective for ordinary cells and temperatures when the radiation received in 15 minutes did not exceed something of the order of 30 r. Moreover, this would hold no matter how concentrated in time within that period this amount of irradiation was.

In irradiation by fast neutrons or by alpha particles with release of protons that make tracks, the tracks are so densely ionized that the number of tracks per cell for a given dose is much smaller. Hence the linear relationship of dose to translocation frequency holds up to far higher doses than it does for roentgen and gamma rays.

Validity of Distinction between Gene and Chromosome Changes. Discussion of this validity is based on Sturtevant's discovery of so-called position effect in the *Drosophila* fly. Roentgen rays could produce both chromosome changes and gene mutations readily in flies, yet in certain higher plants they produced chromosome changes even more readily than in flies, but the gene mutations with much greater difficulty, if at all.

Gene and chromosome changes constitute a real qualitative distinction, even though at times there is doubt as to which class a given change belongs in.

Factors Predisposing to the Production of Chromosome Changes. There are many influences affecting the ease of production of chromosome changes by radiation. External factors such as temperature and infrared must be considered and internal conditions such as physiologic stage, stage of development, condition of chromosome, etc. Cells in mitosis are more readily affected than those of the so-called resting condition. Cells like a brain cell which do not divide would remain unaffected. Both multiple break and single break chromosome aberrations are favored when the tissues irradiated have comparatively many cells in mitosis. The most sensitive stage varies with different cells, however. Chromosome losses and cell deaths caused by single breaks are produced much more readily by irradiation of the condensed chromosomes of the middle mitotic and spermatozoan stages than by irradiation of resting stages, although not so readily as when the early prophase stage is treated.

Probable Role of Chromosome Changes in the Causation of Tissue Damage by Radiation. Embryos are more susceptible than differentiated organisms and young growing organisms are more damaged than older ones. Older ones also tend to have their growth checked. Regeneration is hindered. Preferential damage of tissues in the differentiated organism is accounted for such as skin, hair follicles, uterine epithelium, blood-forming cells, cells of reproductive organs, tumors, especially malignant ones. Chromosome changes account for radiation both "blowing hot" and causing malignant growths, or "blowing cold" by means of chromosome damage induced chiefly during mitosis and destroying the same growths more rapidly than it does the more slowly growing, normal tissues that adjoin them. Some damage to the adjoining normal tissues indirectly damages and promotes resorption of the enclosed tumor. Pathologic effects of radiation such as inflammation and ulcers are probably secondary to the destruction and injury of proliferating cells, and even radiation sickness involving seepage of blood from the vessels is connected with lowered clotting power caused by prior destruction of multiplying cells that form the blood platelets.

Another possible example is lowered disease resistance following irradiation which has been found in experiments on rats. This is probably due to destruction of a significant portion of the rapidly dividing cells from which leukocytes arose. Experimental attempts are described to halt cells in the mid-stage of mitosis by the use of colchicine, and thus make more cells susceptible to radiation at a given treatment. One investigator finds that he can increase the damaging effect of radiation on cancer if he gives a small preliminary dose of radiation and when all the dammed up mitosis takes place in a kind of burst he applies the damaging treatment. He has caught the

cells in a vulnerable phase. Tissue-damaging and generalized somatic-damaging effect of neutrons is at ordinary doses far greater than that of roentgen or gamma rays. Timing of radiation doses in relation to mitotic cycles greatly influences the result.

Other Biological Effects of Radiation, and Their Relation to Genetic Damage. Low doses often cause prompt inhibition and regression of mitosis. Ultraviolet light and chemicals of the mustard gas group, as well as roentgen and gamma rays cause inhibition of mitosis.

Non-genetic damage may go so far as to cause definite abnormalities in development of the embryo and even a high rate of mortality. Genetic damage tends to be more serious and conspicuous in its effects because mutation in a gene is irreparable as is loss of any chromosome part. Change in a gene or chromosome is reproduced and handed down to all the cells derived from it in an individual, and in the case of a germ cell to entire individuals in subsequent generations, and the individual cell and its descendant cells or descended individuals need the whole system of thousands of genes which have to be in the right number relative to one another.

Accumulation of Radiation Damage to the Individual. Some genetic changes are produced even after low intensities of radiation. Recent calculations seem to indicate that the so-called daily tolerance dose hitherto accepted, namely, 0.1 r per day, when applied persistently to mature animals for the remainder of their lives, lowers their life expectancy. Applied to man, 0.1 r per working day persistently applied would result in average shortening of life of about three years and the proposed new "permissible dose" of 0.3 r per week would shorten it by about a year and a half. Question of effect of single exposure during roentgen examination or fluoroscopy is raised. Among medical specialists, radiologists, dermatologists and tuberculosis specialists have the highest mortality rate and they are precisely the groups that deal especially with radiation. A little calculation based on the data given in these papers shows it to be probable that in the end greater accumulated damage is caused to future generations by a given set of exposures of the internal organs now given than to the individual himself.

An inclusive résumé closes the article.

The article includes two figures demonstrating chromosome breakage and translocation.—*J. H. Gilmore, M.D.*

Scott, Kenneth G., and Stone, Robert S. Tumor-host studies. II. Increased concentration of tagged iodotyrosines in the gastrointestinal tract of rats bearing tumors. *Cancer*, July, 1950, *3*, 722–724.

Using normal rats and rats in which lymphosarcoma, adenocarcinoma or neurofibroma had been implanted subcutaneously, the authors injected intravenously mono- and diiodotyrosine tagged with I^{131}. The concentration of this material in the gastrointestinal tracts of these animals was then measured at periods ranging up to twenty-four hours following injection. It was found that animals with tumors weighing more than 8 gm. contained iodotyrosine in their gastrointestinal tracts in amounts directly proportional to the size of the tumor at the end of a twenty-four hour period. This increased amount of the tracer material with comparable amounts in the stomachs of both tumor-bearing and control animals suggests that the increase results from decreased absorption of the material in the intestines of the tumor-bearing animals.

A further conjecture is made that if other amino acids behave as does iodotyrosine a partial explanation for the cachexia in cancer-bearing animals may be at hand.—*D. E. Vivian, M.D.*

Kemler, R. Leonard, and Graham, Evarts A. Studies on the influence of sex hormones on successful heterologous transplantation of human bronchogenic carcinoma. *Cancer*, July, 1950, *3*, 735–738.

A report is presented on efforts of the authors to determine whether sex factors influence the transplantability of bronchogenic carcinoma. This work was suggested by the predominance of this neoplastic disease in the male.

Transplantation of bronchogenic carcinoma into the anterior chambers of the eyes of guinea pigs was done. Animals used consisted of normal males and females, both with and without sex hormonal stimulation, castrated males stimulated with diethylstilbestrol and castrated females stimulated with testosterone propionate. Transplantations were successfully done but the sex of the host or sex hormonal stimulation exerted no demonstrable effect on the growths.

A brief summation of the work of other investigators in transplanting neoplasms is presented—*D. E. Vivian, M.D.*

Bloom, Margaret A. Acquired radioresistance of the crypt epithelium of the duodenum. *Radiology*, July, 1950, *55*, 104–115.

The degree of acquired radioresistance of the crypt epithelium in the duodenum of mice was investigated after closely repeated small doses (60 r) were given to the mice (total body irradiation). Specimens were studied three and twenty-four hours after irradiation. Also, an attempt was made to determine (a) against how large a dose of roentgen rays and (b) for how long a time the increased radioresistance would be effective.

It was found that the crypt cells showed mild damage after 60 r per day, reaching a peak after six to nine daily exposures. After ten or more exposures

these crypt cells became resistant to this daily exposure.

This acquired radioresistance was not sufficient to prevent degeneration of the crypt cells when 600 or 1,200 r was given in a single dose. There was partial protection to 200 r given one day to one week after radioresistance was acquired; however, this protection was lost after a time interval of two to four weeks.—*E. M. Cooper, M.D.*

Nachlas, I. William, and Borden, Jesse N. Experimental scoliosis—the role of the epiphysis. *Surg., Gynec. & Obst.*, June, 1950, *90*, 672–680.

Scoliosis has been attributed to a number of etiologic factors. These are variously classified but may be listed under the following general headings: (1) congenital anomalies, e.g., hemivertebrae; (2) neurologic disease with muscle imbalance, e.g., poliomyelitis; (3) rickets; (4) occupational distortions; (5) extravertebral contractures, e.g., torticollis, chest wall collapse; (6) idiopathic factors.

Microscopic studies of the growing spine show, above and below the bony nucleus of the vertebral bodies, layers of cartilage that are morphologically like the growth plates in the epiphyses of the extremities. These structures are believed to be true epiphyses and the growth of the vertebral body in height is attributed to them. The intervening cartilaginous tissues, the annulus fibrosus and the nucleus pulposus and even the annular "epiphyseal" ring are not credited with growth functions. Until growth ceases, these epiphyses are radiolucent and are therefore roentgenologically indistinguishable from the rest of the intervertebral disc. It appear that when an epiphyseal plate is tilted so that one edge is compressed and the other broadened, the direction of bone growth is changed as the plane of the plate is changed. One can postulate that persistent lateral tilting of the spine compresses the epiphyseal plate on the concave side and allows widening on the convex side. Bone growth is more rapid on the widened side so that the direction of vertebral elongation is at an angle to the original axis. The deformity is progressive. Progression of the deformity is spontaneously retarded when the growth urge ceases. Adults, in whom epiphyses are lacking, tend to be immune to the formation of severe scoliosis.

No one knows what starts the unequal growth rate that leads to the lateral curvature in idiopathic scoliosis. Trauma is hardly a factor since the deformity occurs far more frequently in girls than in boys.

Animal (dog) experiments were performed by the authors. In those in which staples were imbedded in one side of the vertebral bodies, a lateral deviation of the spine with varying degrees of vertebral rotation developed. The degree of curvature seemed to vary with the age of the animal at operation, the length of time the animal was subjected to growth restraint and the amount of growth the puppy developed in reaching maturity.

If this process can be applied to scoliotic children it offers a hope for the cure of a condition for which no satisfactory treatment has as yet been formulated.—*Mary Frances Vastine, M.D.*

Rugh, Roberts. The effect of x-radiation on squid larval tropisms. *Biol. Bull.*, June, 1950, *98*, 247–253.

Pre-hatched squid embryos survived 185 kv. (peak) roentgen exposures of 200,000 r for four days or more. Growth was stopped promptly by 5,000 r or more, but no dose used (up to 200,000 r) effected motility or smooth muscle function. Irradiation of squid embryos in their jelly with 25,000 r induced hatching, in most, by swelling of the jelly and bursting of the capsule; 50,000 r induced hatching in 100 per cent. The strong phototropism of recently hatched squid larvae was abolished in many specimens by irradiation with 10,000 r, but 100,000 r was needed to abolish the response in all larvae. Negative geotropism of squid larvae was reduced by 50,000 r, and abolished by 100,000 r. Histological effects of irradiation were most evident in the retina and lens, appearing after three or four days. The retina showed extensive disorganization following 800 r or more.—*H. P. Brean, M.D.*